Kentucky's Wonderful Commonwealth of Water

Middle School Unit
Be an Informed Water Citizen

Kentucky's Wonderful Commonwealth of Water
Middle School

UNIT SUMMARY

This unit leads students through an exploration of why we have water problems, what those problems are and how they can be addressed. It culminates with an issue analysis activity in which students use research skills to investigate various sides of water issues they choose and then calls on student to design service-learning projects to address water issues in their communities.

In this unit, students will learn the following things

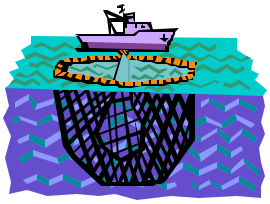
- ◊ There is only a limited amount of water on earth
- ◊ The hydrologic cycle
- ◊ How important water is to everyday life
- ◊ How much water we actually consume
- ◊ What a watershed is and how watersheds become polluted
- ◊ How to map their own watershed and "see" how water flows
- ◊ How point and nonpoint source pollution gets into our water
- ◊ How to think critically about water issues
- ◊ How to develop service projects to address water problems

Suggested Open Response Question – You are a member of the city council in your hometown. The council has just been told that a small stream that runs through the middle of town is severely contaminated with the bacteria found in human and animal waste. Describe how you will find the source of this contamination and give two strategies for how you would clean it up.

Portfolio suggestion: Have students choose a water issue of concern in your community. Ask them to write a persuasive paper on the issue, using the "Let's Analyze the Issues" sheet at the back of the unit as a guide for developing their paper.

Technology extensions

- ◊ Use Geographic Information Systems technology to investigate sources of drinking water and of waste water disposal in your community.
- ◊ Use a spreadsheet to record how much water each class member uses for one week (see activity "How valuable is Water?)



Kentucky's Commonwealth of Water—Be a Water Explorer
Middle School

Unit Essential Question: How can we learn to protect our water?

Standards

Science

Science SC-M-2.1.5, Students will understand that water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water dissolves minerals and gases and may carry them to the oceans.
Scientific Inquiry, Students will use evidence (e.g., computer models), logic, and scientific knowledge to develop scientific explanations.

Social Studies

Social Studies SS-M-3.1.1, Students will understand that productive resources are limited and do not satisfy all the wants of individuals, societies, and governments (scarcity).
Social Studies SS-M-4.1.1, Students will understand that maps, globes, photographs, models, and satellite images are representations of Earth with different characteristics and uses.
Social Studies SS-M-4.2.1, Students will understand that places can be made distinctive by human activities that alter physical features.
Social Studies SS-M-4.4.4, Students will understand that individual perspectives impact the use of natural resources (e.g. watering lawns, planting gardens, recycling paper).
Social Studies SS-M-1.1.2, Students will understand that democratic governments function to preserve and protect the rights (e.g., voting), liberty, and property of their citizens by making, enacting, and enforcing appropriate rules and laws (e.g., constitutions, laws, statutes)

Math

Math MA-M-1.2.1, Students will compute (e.g., estimate, use pencil and paper, use calculator, round, use mental math) large and small quantities and check for reasonable and appropriate computational results.
Math MA-M-2.2.3, Students will develop and apply proportionality and relationships between scale models and actual figures.

Practical Living

Practical Living PL-M-3.1.5, Students will understand that environmental issues should be considered when making consumer decisions (e.g., recycling, reducing, reusing)

Unit Overview	
Lesson	**Title and Description of Activities, Essential and Guiding Questions and Standards**
# 1	**"What's All the Fuss About? " —**Students will recognize that there is a lot of water in the world, but that only a very small percentage of it can be used for drinking water and other water supply needs. **Scientific Inquiry,** Students will use appropriate equipment, tools, techniques, technology, and mathematics in scientific investigations. **Standards:** Science: SC-M-2.1.5 **Essential Question**: How can we learn to protect our water? **Guiding Questions:** • Why isn't all fresh water usable? • Why do we need to take care of the surface water and ground water?
# 2	" **Water" You Supposed to Be?"—**Students will learn about the different parts of the hydrologic (water) cycle as they participate in a game of charades. **Standards:** Science: SC-M--2.1.5. **Introduced:** Arts and Humanities: AH-M-3.1.4 **Essential Question:** How can we learn to protect our water? **Guiding Questions:** • What are the parts of the hydrologic cycle and why is it important?
# 3	**"How Valuable is Water?"—**Students will work to budget the amount of water they use in order to save "Water dollars". They will also investigate why water is essential for day to day living and how water contributes to the standard of living in Kentucky. Finally, Students will create a game to teach others about water. **Standards:** Math: MA-M-1.2.1, Practical Living: PL-M-3.1.5 and Social Studies: SS-M-3.1.1 **Essential Question:** How can we learn to protect our water? **Guiding Questions:** • How do we use water on a daily basis? • Why is water essential for day to day living? • How does water contribute to the standard of living in Kentucky? • How can we conserve water?
#4	**"Just How Much Water Are We Talking About?"—**Students will calculate the value of one million gallons of water by comparing it to the volume of their classroom. They will also learn about water consumption in Kentucky and calculate the estimated cost of water. **Standards:** Math: MA-M-2.2.3 and Social Studies: SS-M-3.1.1 **Essential Question:** How can we learn to protect our water? **Guiding Question:** How much water do we use on a daily/yearly basis?

Unit Overview

Lesson	Title and Description of Activities, Essential and Guiding Questions and Standards
# 5	**Race You to the Top of the Hill"—**Students will learn about reading and drawing topographic maps and watersheds by traveling outside their school and mapping their local micro-watershed. **Standards:** Math: MA-M-2.2.3 and Social Studies: SS-M-4.1.1 **Essential Question:** How can we learn to protect our water? **Guiding Questions:** • Why are topographic maps important? • What is a micro-watershed? • How can I find and draw my micro-watershed?
# 6	**" Follow the Flow"—**Students will use maps to identify their local watershed areas for 3 of Kentucky's major rivers. Students will also use mathematical skills to recreate a scale map of their watershed area. **Standards:** Social Studies: SS-M-4.1.1 **Essential Question:** How can we learn to protect our water? **Guiding Questions:** • Where is my watershed? • Why is it important to learn about watersheds?
#7	**Lets Make a Watershed Model"—**Students will create mini-watershed models that show examples of point and non-point pollution sources and natural filters in a community. Students will also identify the interrelationships between a community and its watershed. **Standards:** Science: SC-M-2.1.5 and Social Studies: SS-M-4.2.1 **Essential Question:** How can we learn to protect our water? **Guiding Questions:** • What are some of the causes of water pollution? • What natural and manmade filters help clean water?
#8	**"Whose Side Are You On?"—** Students will be introduced to the critical thinking process of " Issue Analysis" as they role play to answer the question, " Which group should be given custody of the last Truffula Tree seed?" **Standards:** Social Studies: SS-M-4.4.4 **Essential Question:** How can we learn to protect our water? **Guiding Question:** What is Issue Analysis and how can we use it to study current issues?

Unit Overview	
Lesson	**Title and Description of Activities, Essential and Guiding Questions and Standards**
#9	"**Curiosity Rules!"—** Students review all the questions that have been placed on the board during the unit and match to facts and concepts they have learned. An extension allows student to research questions that have not been answered during the unit. **Standards:** Science: S-8-SI-3**,** Students will use evidence (e.g., computer models), logic and scientific knowledge to develop scientific explanations. **Essential Question:** How can we learn to protect our water? **Guiding Question:** How can I continue to learn about water and how it affects me?
#10	"**Let's Analyze the Issues!"—** Students will use steps involved in "Issue Analysis" to identify, research, write about, and present current water resource issues in Kentucky. **Standards:** Social Studies: SS-M-1.1.2, Social Studies: SS-M-4.4.4 and Writing-WR-M-1.4. **Essential Question:** How can we learn to protect our water? **Guiding Questions:** • What is a current water resource issue in our community or state? • How did the controversy begin? • Where is the controversy heading? • Who controls the resources that could resolve the issue? • What beliefs/values are at conflict with this issue? • What stand are you going to take on this issue? • Are you unable to support your stand with unbiased evidence?
#11	"**Now's the Time to Act!"—** Students will work in small groups to design and implement a plan of action in their community to protect or conserve water. **Standards:** Social Studies: SS-M-1.1.2 **Essential Question:** How can we learn to protect our water? **Guiding Question:** What is a service learning project that is feasible for us to do, and will help make us more responsible water users?

Making The Unit More Inquiry-Based

Nearly all the activities in this unit are designed to help students ask questions and do some basic research on topics related to water quality in our state. However, a simple exercise woven throughout the unit can increase the numbers of questions asked by the students and make them your partners in finding answers to those questions. Here is how it works.

At the beginning of the unit, make (or have students make) about 100 wavy strips of colored paper long enough on which to write a question. (Strips should look like a stream or river) Also make (or have students make) about 100 drops of water on colored paper. These should be large enough on which to write an answer or fact. Also, designate a bulletin board or wall in the classroom as your "Water Discovery Area". Place the paper in two boxes near the water discovery area. Label the two boxes, "question strips" and "answer drops".

Encourage students to both ask questions in class and to write any questions they have on one of the question strips. They should then attach these to the water discovery area. Also tell students that each time they learn something new about water they are to write that new knowledge on an answer drop. (Students may need a little guidance at first.)

Throughout the unit pause occasionally to match question strips with answer drops. Explain to students that gaining knowledge is similar to the water cycle. It really never ends because each new question needs an answer and, very often, each new answer raises a new question. Also explain that, just as water changes forms, the answers to questions change as we gain new knowledge through science and inquiry.

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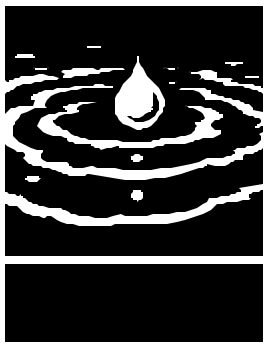

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Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

What's All the Fuss About?

Adapted from *Water: The Resource That Gets Used and Used and Used for Everything* Poster; USGS, Reston, VA,

Standards

Scientific Inquiry, Students will use appropriate equipment, tools, techniques, technology, and mathematics in scientific investigations.
Science: SC-M-2.1.5, Students will understand that water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water dissolves minerals and gases and may carry them to the oceans.

The following standard is introduced in this activity
Social Studies: SC-M-3.1.1, Students will understand the concept of scarcity (imbalance between unlimited wants and limited resources) as it applies to individuals, societies, and governments across geographic regions.

Activity Description

Students will recognize that there is a lot of water in the world, but that only a very small percentage of it can be used for drinking water and other water supply needs.

Materials

- Class set of activity sheets found at end of lesson/pencils

(One set of the remaining materials for each lab group)

- Four 1000 ml graduated cylinders
- One water dropper

Length of Lesson

60-90 minutes plus homework assignment

Vocabulary Words

Fresh water: inland water that has a low concentration of minerals, salts, and dissolved solids found as surface water or groundwater.
Surface water: precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration. It is stored in streams, lakes, rivers, ponds, wetlands, oceans, and reservoirs.
Groundwater: water that infiltrates the earth and is stored in usable amounts in the soil and rock below the earth's surface; water within the zone of saturation.

Essential Question

How can we learn to protect our water?

Guiding Questions

- Why isn't all fresh water usable?
- Why do we need to take care of the surface water and ground water?

Skills Used

Compare	Analyze	Compute
Organize	Graph	Write
Reflect	Experiment	Teamwork

What's All the Fuss About?, *continued*

Activity

Step 1: Gather the materials needed to complete this activity prior to class time. Refer to **Teacher Fact Sheets** for background information about the amount of water on Earth.

Step 2: Introduce this water unit of study by telling students that they will be learning about Kentucky waterways, current water issues and things they can do to become responsible Kentucky water users. Encourage students to begin looking for newspaper and magazine articles related to this unit. Ask them to bring the articles to school as they find them, making sure they include the sources from which they obtained the articles, and the date of the publication. It might also be a good idea to begin collecting water pictures to use in later student publications. Make water droplet cutouts so students can record water facts as they learn them and question strips so they can keep track of what more they want to know as the unit progresses. Keep both droplets and question strips posted in the room for use throughout the unit.

Step 3: Explain that, in this first activity, each group of students will be conducting an activity to compare the total amount of estimated water found on Earth to the amount of fresh water that is usable. Then (in a follow-up activity) they will calculate how much usable water is available for each person on earth.

Step 4: Pass out lab equipment and the first activity sheet found at the end of this activity. Go over the sheet with students and offer explanations where needed. Define the terms fresh water, saltwater, ground water, and surface water.

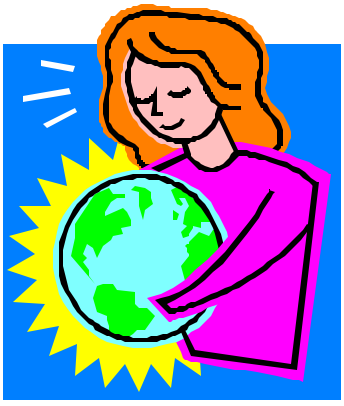
Step 5: Instruct students to begin the activity, following instructions on Activity Sheet 1.

Step 6: Once the measuring part of the activity has been completed, hold a class discussion to see what questions students have about the scarcity of water. Record any questions on question strips. Use water from the activity to water plants.

Step 7: Distribute the second activity sheet. Instruct students to work together to do the calculations and find the answers.

Step 8: Discuss answers on both sheets with students. Ask if the numbers surprised them and if they realized that such a small percentage of the water in the world is usable.

Step 9: Have students visit the website http://www.uswaternews.com/archives/. Have each group choose a story from the page and report the story and the issues surrounding it to the rest of the class. Discuss the articles and issues with students. Record any questions they have and any new facts they have learned.



What's All the Fuss About?

Activity Sheet 1

Procedure

1. Fill container A with blue colored water to the 1,000 ml line. This represents the earth's entire supply of water.

2. Pour 30 ml of the total water from container A into a second 1,000-ml graduated cylinder. The 30 ml of water in container B represents the earth's total fresh water supply. The remaining 970 ml of water is salt water. Label container A "salt water" (You may actually put some salt in it to make the point.)

3. Of the world's fresh water (in container B) approximately 80% is frozen in the polar icecaps or in glaciers. Pour this amount, which is 24 ml, into container C. Label container C "ice caps and glaciers." Place it next to container A.

4. Of the world's fresh water that is NOT frozen in ice caps or glaciers (now represented in container B), approximately 99.5% is either too polluted or too far underground to be used. Using the water dropper, take one drop of the remaining water and put it into the final container labeled container D. (This drop represents all the water on earth that we can use to meet our human needs.) Label container B "polluted water and unreachable groundwater" and label container D " usable water".

After completing the activity, have a discussion about your findings and record any questions students may have. Put these on the question board along with new facts you have learned during this experiment. During the discussion, discuss the following questions as well. (Note: Students may need to do research to find the answers to these questions.)

1. Which of the fresh water graduated cylinders represents the most fresh water on Earth?

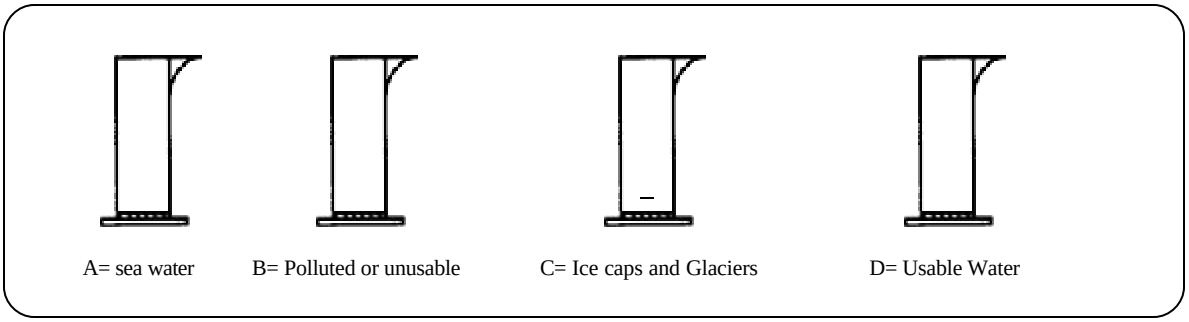
2. Is this a source of fresh water commonly used by humans for drinking, watering the lawn, etc.? Explain.

3. Approximately what percentage of Earth's fresh water is ground water?

4. Where is most of Earth's water found?

5. Can cities such as San Francisco, Miami, and New York City, which are near oceans, use the water from the oceans for households and industry? Explain.

6. Can the salts be removed from the water? Why do you think this isn't commonly done?



What's All the Fuss About?

Activity Sheet 2

Water and population facts	
Amount of water on earth	= 280 billion liters
Percentage of water on earth that is in the oceans	= 97%
Percentage of remaining fresh water that is frozen in the polar ice caps and glaciers	= 80%
Percentage of fresh water not in the icecaps or glaciers but still unavailable for human use	= 99.5%
Total number of people on earth as of 1/01/02	= 6,211,666,092
(Go to http://www.ibiblio.org.lunarbin/worldpop/ for the latest population figures.)	

1. Using the chart above, divide the total amount of water on earth by the total population on earth. Remember, the total amount of water never goes up but population does. Record your answer. _____

2. Now, calculate the amount of water in the oceans and subtract that amount from the total amount of water on earth. This is the amount of fresh water on earth. Divide this amount by the total number of people on earth. This is how much fresh water there is for each person on earth. Record your answer. _____

3. Now, calculate how much of the fresh water on earth is tied up in the polar ice caps and glaciers and subtract that from the total amount of fresh water. Divide this amount by the total number of people on earth. This is how much fresh water, not tied up in polar ice caps, there is for each person on earth. Record your answer. _____

4. Finally, calculate out how much of the fresh water that is not tied up in the icecaps is too polluted or too difficult to reach. Subtract this from your last total and divide this by the number of people on earth. This should give you how much water is available for each person to use. Record your answer. _____

5. Remember, the population keeps going up, but the amount of water does not. Write at the bottom of this sheet why you think it is, or is not, important for people to know this.

_____

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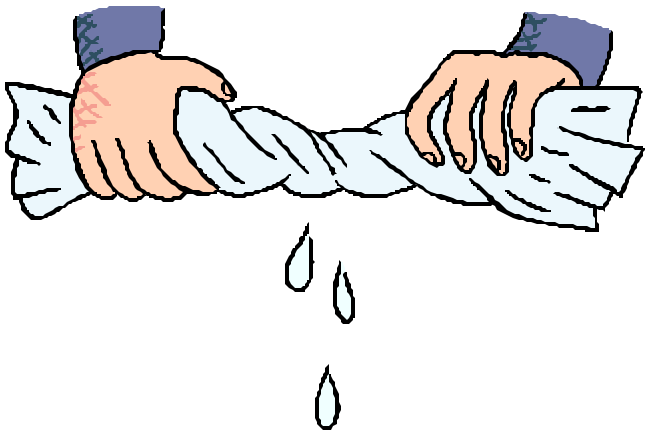
What's All the Fuss About?, *continued*

Extension

Have students look at the USGS map at http://water.usgs.gov/realtime.html (or do a internet search on U.S. water conditions.) This map shows available water for use. Ask students if they notice differences in the amount of water available for use in the eastern and western part of the country. Also have students look at the website http://www.uswaternews.com/archives/arcsupply/arcsupply.html which is a news source for water scarcity articles and issues. Have students or student groups report on issues that relate to water scarcity.
Have students role play the following scenario or create other role plays from articles they read on the water news website.

What if the severe drought conditions experienced in 2002 continue? Have students role play a debate between two western land owners. One who needs water for his cattle and the other who lives upstream and is using nearly all the available water to irrigate his crops.

Assessment: Ask students to write a portfolio piece which explains what they learned in this activity about water and population. Ask them to include how they think water scarcity may affect people now and in the future. Make sure they use examples, either from water news, or from their imaginations, of problems they think might be caused by water scarcity.



Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

"Water" You Supposed to Be?

Adapted from "ACTING THE WATER CYCLE", P. 7, *Splashing in Kentucky!*, Kentucky Waterways Alliance, 1998

Standards

Science: SC-M-2.1.5, Students will understand that water, which covers the majority of the Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water dissolves minerals and gases and may carry them to the oceans.
(The next standard is introduced in this activity)
Arts and Humanities: AH-M-3.1.4, Students will create characters using the elements of performance.

Activity Description

Students will learn about the different parts of the hydrologic (water) cycle as they participate in a game of charades.

Materials

Index cards containing each group's role in the hydrologic cycle along with definition. (See **Step 2**.)

Length of Lesson

60 – 90 minutes

Vocabulary Words

Atmosphere: The layer of gases surrounding Earth.
Condensation: process in which a gas (water vapor) changes into a liquid. A cloud is the visible collection of water vapor in Earth's atmosphere.
Evaporation: process in which the heat energy of the sun causes the water on the earth's surface to change into a vapor.
Ground water: water that infiltrates the earth and is stored in usable amounts in the soil and rock below the earth's surface; water within the zone of saturation.
Hydrologic cycle: continuous movement of water throughout Earth's atmosphere including evaporation, transpiration, condensation, precipitation, runoff, infiltration and accumulation.
Infiltration: the process by which water seeps into the ground.
Precipitation: any type of water falling from the atmosphere (rain, snow, hail, sleet).
Runoff: water (originating as precipitation) flowing across the earth's surface (rather than seeping into the ground) that eventually enters a body of water.
Surface water: precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration. It is stored in streams, lakes, rivers, ponds, wetlands, oceans, and reservoirs.
Transpiration: the process by which water absorbed through plant roots evaporates from the leaves.

Essential Question

How can we learn to protect our water?

Guiding Question

What are the parts of the hydrologic cycle and why is it important?

Skills Used

Analyze	Apply	Communicate	Describe
Discuss	Identify	Listen	Observe
Role play	Visualize	Teamwork	Create

"Water" You Supposed to Be?, *continued*

Activity

Step 1: Remind students at the beginning of this lesson that they have probably learned about the hydrologic (water) cycle over and over again in previous years. Explain to students that they will be reviewing the different parts of the hydrologic cycle a little differently in this lesson — they will be playing charades, and acting out their assigned part of the cycle. Explain that, unlike charades, sound (not words) may be added to help classmates guess what they are. Divide the class into 10 groups and secretly give each group an index card that has the role the group will be playing in the hydrologic cycle, along with a definition. The roles are listed below: Cards may be made from the page following this one.

sun	**surface water**
atmosphere	**runoff**
evaporation	**condensation**
groundwater	**precipitation**
infiltration	**transpiration**

Step 2: Explain that each group of students will work as quietly as possible together to decide the best way to act out their role in the classroom improvisations. Give students approximately five minutes to get their acts ready. Answer any questions quietly within each group, so the different roles are secret until game time.

Step 3: Begin the activity. (**NOTE**: Teachers may decide to post a list of the terms, or a picture of the hydrologic cycle, in the classroom prior to the start of the game of charades. That should not take away from the focus of this lesson, which is to actively encourage students to internalize the different steps in the hydrologic cycle.)

Step 4: After all groups have performed, instruct the students to arrange their groups in a logical order, according to the hydrologic cycle, and follow a drop of water through the cycle as each group takes a turn acting out its action and sound.

Step 5: Conclude the activity by explaining that the homework, which is also the assessment, will be for students to individually create a product that shows the different parts of the water cycle to present to the class. Emphasize that accuracy and creativity are the main focus of this product, and that students may use any avenue they wish to show that they understand the hydrologic cycle. Products could include a poster, clay animation, mobiles, bulletin board, PowerPoint presentation, video, etc. Set a reasonable deadline for completed projects to be brought to school, and allow time in class to share and display the projects once they are completed.

Step 6: Grade the projects using the rubric found on the next page. **NOTE:** The rubric should be available for students to reference when preparing project and presentation.

Extensions

1. Use music, such as Vivaldi's *Four Seasons*, as background during the final class production.

2. Videotape the final class performance and/or the individual presentations to send to local elementary schools so teachers might use the material to introduce, or review the hydrologic cycle with their younger students.

3. Display projects in a prominent place in the school building, and/or post them on the school, or class, web site.

4. Do the activity "Imagine" on page 252 of Project WET.

Q&A - Remember to allow students an opportunity to write questions they have on the question board.

Cards to be used by groups in the hydrologic cycle charades game

Sun	Atmosphere
Evaporation	Transpiration
Surface Water	Runoff
Infiltration	Groundwater
Condensation	Precipitation

Hydrologic Cycle Presentation Rubric

Student Name _____ **Date** _____

Teacher Name _____ **Class** _____

CATEGORY AND SCORE	4	3	2	1
Accuracy of Retelling the Hydrologic Cycle Story	The storyteller includes all major points and several details of the hydrologic cycle. The concept is easy to understand and is logical. There are no loose ends.	The storyteller includes all major points and 1-2 details of the hydrologic cycle. The concept is easy to understand and is somewhat logical.	The storyteller includes all major points of the hydrologic cycle, but the concept was a little hard to understand.	The storyteller forgets major points of the hydrologic cycle and the concept of the water cycle was impossible to understand.
Knows the Story	The storyteller knows the story well and has obviously practiced telling the story several times. There is no need for notes and the speaker speaks with confidence.	The storyteller knows the story pretty well and has practiced telling the story once or twice. May need notes once or twice, but the speaker is relatively confident.	The storyteller knows some of the story but did not appear to have practiced. May need notes 3-4 times, and the speaker appears ill-at-ease.	The storyteller could not tell the story without using notes.
Connections/ Transitions	Connections between the components of the hydrologic cycle in the story are creative, clearly expressed and appropriate.	Connections between the components of the hydrologic cycle in the story are clearly expressed and appropriate.	Connections between the components of the hydrologic cycle are sometimes hard to figure out. More details or better transitions are needed.	The story seems very disconnected and it is very difficult to figure out the story.
Visual Setting	Lots of vivid, accurate, descriptive visual effects are used to show the audience when and where the hydrologic cycle takes place.	Some vivid, accurate, descriptive visual effects are used to show the audience when and where the hydrologic cycle takes place.	The audience can figure out when and where the hydrologic cycle takes place, but there is not much visual detail.	The audience has trouble telling when and where the hydrologic cycle takes place.
Acting/ Dialogue	The student uses consistent voices, facial expressions and movements to make the presentation more easily understood.	The student often uses voices, facial expressions and movements to make the presentation more easily understood.	The student tries to use voices, facial expressions and movements to make the presentation more easily understood.	The student tells the story but does not use voices, facial expressions or movement to make the storytelling more interesting or clear.

_____ **Total Score** **Comments:**

Kentucky's Wonderful Commonwealth of Water – Be an Informed Water Citizen

Middle School

How Valuable *Is* Water?

Water Dollar Activity Adapted from "The Value of Water", USGS Water Resource Education, Water Poster Series, 1993

Standards

Math: MA-M-1.2.1, Students will compute (e.g., estimate, use pencil and paper, use calculator, round, use mental math) large and small quantities and check for reasonable and appropriate computational results.
Practical Living: PL-M-3.1.5, Students will understand that environmental issues should be considered when making consumer decisions (e.g., recycling, reducing, reusing)
Social Studies: SS-M-3.1.1, Students will understand that productive resources are limited and do not satisfy all the wants of individuals, societies, and governments (scarcity).

Activity Description

Students will work to budget the amount of water they use in order to save "Water Dollars". They will also investigate why water is essential for day-to-day living and how water contributes to the standard of living in Kentucky. Finally, students will create a game to teach others about water.

Materials

- 5 pages of Water Dollars (located at end of activity) per student
- Class set of Table 1 (located at end of activity)
- Class set of Table 2 (located at end of activity)
- Variety of art materials to assist students in making a water game.

Length of Lesson

Approximately 3-5 days

Vocabulary Word

Conservation—the protection or wise use of natural resources that ensures their continuing availability to future generations.

Essential Question

How can we learn to protect out water?

Guiding Questions

- How do we use water on a daily basis?
- Why is water essential for day-to-day living?
- How does water contribute to the standard of living in Kentucky?
- How can we conserve water?

Skills Used

Analyze	Apply	Communicate	Calculate
Organize	Collect Data	Plan	Create

How Valuable *Is* Water?, *continued*

Activity

Step 1: Divide students into small groups, giving them instructions to list ways they, personally, use water. Give students about 5 minutes to complete this activity.

Step 2: Bring students back together and make a master list, either on an overhead projector, or directly on a computer, if classroom "presenter" is available to connect the computer to the classroom television. (Use the table setup at the bottom of this column.)

Step 3: Explain to students that, in an attempt to arrive at a rough estimate of how much water individuals use on a daily basis, they are going to be responsible for keeping a ledger showing how many times they use water for various activities during a 24 hour period.

Step 4: Give students a copy of the completed table, (or have students copy it onto a sheet of paper) and ask them to carry it with them for the next 24 hours and mark it each time they directly use water. Remind students to return completed tables to class the following day so the collected information can be used to continue the activity.

ACTIVITY	# of times
Brush teeth	
Take a shower	
Take a bath	
Shave	
Flush toilet	
Get a drink	
Wash hands	
Wash food	

Step 5: After preparing the table, ask students to think about, and discuss, how water is used across the state of Kentucky, not just for individual use, but in other ways. Separate the uses into two categories — instream use (recreation, transportation, plants, animals and hydroelectric power) and offstream use (homes, industry, . . .).

Step 6: Conclude this class session by encouraging students to think about their own county and the many ways water is used. Ask students to take a close look as they head home from school at all of the businesses, farms, homes, and recreational facilities (as well as plants and animals) that depend on water every day. REMIND STUDENTS TO RETURN HOMEWORK!

Day 2

Step 1: Before class time, make a class set of Table 1 and Table 2, and 5 sheets of Water Dollars for each student (all found after this activity). Ask students to use the information they collected on personal water usage over the 24 hour period to fill in Table 1. Explain that, using the conversion table at the top of the worksheet, they will convert the gallons to liters, then multiply to find the total amount of gallons and liters of water they used during the previous 24 hours. (**NOTE:** The correct answers are found on Table 2, but students do not need to see this sheet yet.)

Step 2: Once the conversion table has been completed, pass out, to each student, 5 sheets of the "Water Dollars" (found after Table 2) for students to cut apart.

How Valuable *Is* Water?, *continued*

Step 3: Explain that each student has the same amount of Water Dollars (370 Water Dollars each), and that they are going to have to pay for the amount of water they used during the last 24 hours. Explain that it costs one Water Dollar for every liter of water used and that they need to round up to the nearest liter when calculating the amount of money they owe for their use of water.

Step 4: Instruct students to return the spent Water Dollars to the teacher, or the appointed Water Dollar Banker (a student or parent volunteer). Students should discover that it does not take very long to use up all of their Water Dollars. If students run out of Water Dollars, ask for ideas on what they might have to do in real life to afford to pay for their water. Remind students that there are many choices that consumers must make, when they have a limited amount of money to spend for goods and services. Ask students to think about, and discuss, times when they were on a limited budget and could not buy things they really wanted and the compromises they had to make. Explain that as young adults, they have a responsibility to use water wisely, so the quality of life and the quantity of freshwater we enjoy today in Kentucky will be available for future generations.

Step 5: Explain to students that they will have a chance to learn to spend their Water Dollars more wisely in the next 24 hours by trying to conserve (or cut down) on the amount of water they are using to do everyday tasks. Pass out Table 2, which contains ways to conserve water. Explain that the students will once again keep track of the amount of water they use over the next 24 hours. This time, though, they have a chance to earn refunds, if they choose to conserve the amount of water they use. For example, when brushing teeth, if they conserve water by turning it off instead of allowing it to run as they brush, they will get a refund of 7 water dollars (8 liters – 1 liter = 7 liters of water saved).

Encourage students to try to budget their Water Dollars so they have as much money as possible left over after paying for their water purchases in class the next day. (Incentives that are meaningful to students may be given to students who have the most money left by receiving water refunds in class on the following day.)

Step 6: Ask students to return all Water Dollars until the next day of class. Also, ask students to keep Table 1 in their class notebooks so they can compare their personal water consumption in class the next day.

Day 3

Step 1: Prior to class on the third day of this activity, sort the Water Dollars into groups of 370 Water Dollars for each student (10 tens, 10 twenties, 10 fives and 20 ones).

Step 2: When students arrive, as on Day 2, have them figure out how much money they have to spend for their water consumption. If they used water conservatively, though, they will receive their refunds. (Students or parent volunteers may be appointed as "Bankers" to distribute Water Dollar refunds to students who conserved their use of water.) Once refunds have been made, ask students to share with the entire class how much money they had left after budgeting the way they used water. Also, ask students to reflect on, and write about this experience in their class notebooks.

How Valuable *Is* Water?, *continued*

Optional Activity

Step 1: Once the Water Dollars have been put away for the day, remind students that in real life adults must purchase water from local water companies. Explain that the price of water differs from community to community, but that currently, the cost for residential customers in Kentucky is about $2.75 per 1,000 gallons of water up to 40,000 gallons. On top of this cost, homeowners must also pay a monthly service charge that is determined by the local water company. An average monthly service charge could run about $7.70 for a 5/8 inch residential connection line. Explain that water utility companies must bring in enough money to pay all of their expenses, plus have access to revenue in case equipment has to be repaired, new structures built, etc.

Step 2: Instruct students to use the information found on Table 2 to estimate the amount of water their ENTIRE FAMILY used (in gallons) over the past 24 hours. Instruct them to multiply that amount by 30 to determine an estimate of the amount of water used in one month. (Remind students to be sure to consider extra activities such as washing the car, watering the lawn, or filling the swimming pool.) Ask students to calculate their family's monthly water bill, based on a rate of $2.75 per 1,000 gallons of water, with a service charge of $7.70 added to the total bill.

Step 3: Instruct students to take their final calculation home and check it with a real water bill to see how accurate their estimate was on how much their parents must pay for the privilege to have water pumped into their home.

Step 4: Challenge students to think about what would happen to the cost of water, as well as the quality of water in Kentucky, if people pollute existing surface water, or do not conserve the amount of water they personally use.

Assessment

Step 1: Remind students that they have had an opportunity to play a game using the Water Dollars to learn about water conservation. Explain that they will be working in small groups to create a new game to teach people about conserving and protecting Kentucky's water. Tell students that the game can be designed to appeal to an older or younger audience. If desired, make Internet web sites available so students can do more research to come up with a variety of facts, or make copies of the Kentucky fact sheets found in the **Teacher Fact Sheets.**

Step 2: Share the grading rubric (found at the end of this activity) so students will understand how their games will be graded. Allow class time for students to work on games, and set a deadline for completion.

Step 3: If possible, team up with other classes within the school to field test the completed games. This would be a great way to spread the word about the importance of taking care of Kentucky's water!

Extensions

1. Invite a speaker from the local water company to talk to the class about their line of work, and how the local water system works to get water to consumers.
2. Assign students to investigate how much water is used on a monthly basis at school. What is the monthly cost of water at school? Is the school charged the same rate (price per gallon and service charge) as residential, or home, customers?
3. Challenge students to encourage family members to conserve water at home. After a few weeks, have students write about changes that have been made at home to cut down on water usage. Are families seeing a decrease in monthly water bills?

Estimated Daily Water Usage Table 1

Name_____ **Date**_____ **Class**_____

Directions: Over the next 24 hours complete this chart, based on water used during one typical day. Please return this completed chart to class tomorrow. Thank you!

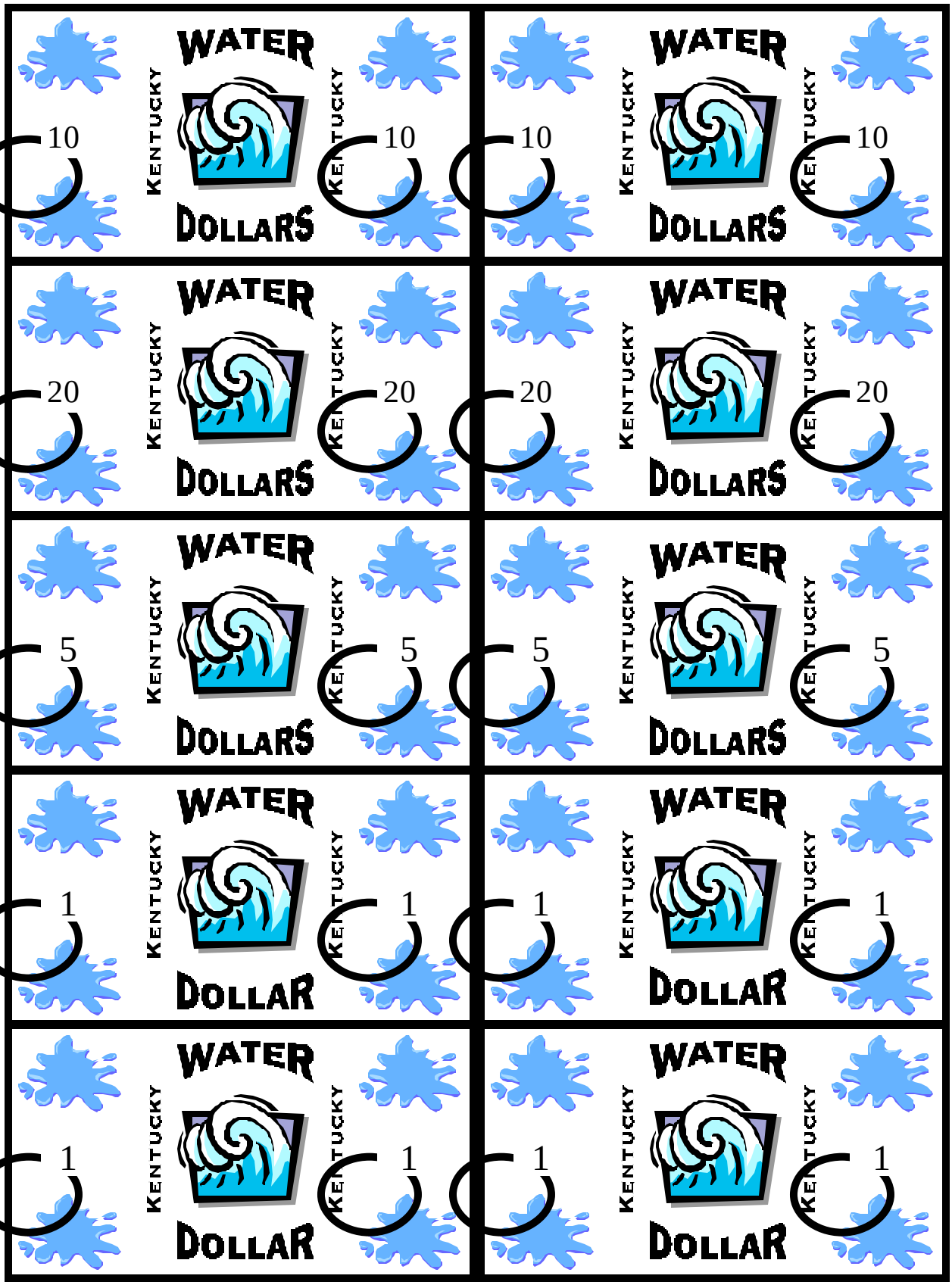
ACTIVITY	**Total Number of Times**	**Estimated Gallons of Water Used With Normal Usage**	**Convert to Liters (Multiply the # of gallons by 3.8)**	**Total Gallons / Liters of Water Used (Multiply # of times by gallons then liters)**
Example: Shave	2	15 gallons	15 x 3.8 = 57 liters	2 x 15 = 30 gallons 2 x 57 = 114 liters
Brush teeth		2 gallons		
Take a bath		40 gallons		
Take shower		50 gallons		
Shave		15 gallons		
Flush toilet		5 gallons		
Get a drink		1 gallon		
Wash hands or face		2 gallons		
Cook a meal		3 gallons		
Wash dishes by hand		30 gallons		
Run a dishwasher		16 gallons		
Do a load of laundry		60 gallons		
Watering lawn		300 gallons		
Washing car		50 gallons		
			Total Water Used	

Estimated Daily Water Usage Table 2

Name_____ **Date**_____ **Class**_____

Directions: Work at home, with family members to complete this chart, based on water used during one typical day. Please return this completed chart to school tomorrow. Thank you!

ACTIVITY	Total Number of Times	Estimated Gallons of Water Used With Normal Usage	Estimated Gallons of Water Used With Conservative Usage	Total Gallons of Water Used
Brush teeth		Water running 2 gallons / 7.6 liters	Water turned off .25 gallon / 0.95 liter	
Take a bath		Full tub 40 gallons / 152 liters	Low water 10 gallons / 38 liters	
Take shower		Standard shower head 50 gallons / 190 liters	Low flow shower head 25 gallons / 95 liters	
Shave		Water running 15 gallons / 57 liters	Plug & fill basin 1 gallon / 3.8 liters	
Flush toilet		Standard flow toilet 5 gallons / 19 liters	Low flow toilet 1.5 gallons / 5.7 liters	
Get a drink		Run water to cool 1 gallon / 3.8 liters	Keep water in fridge 0.062 gallon / .24 liter	
Wash hands or face		Water running 2 gallons / 7.6 liters	Plug and fill basin 1 gallon / 3.8 liters	
Cook a meal		Water running to wash vegetables: 3 gallons / 11.4 liters	Wash vegetables in bowl: 1 gallon / 3.8 liters	
Wash dishes by hand		Water running 30 gallons / 114 liters	Wash & rinse in sink: 5 gallons / 19 liters	
Run a dishwasher		Full cycle 16 gallons / 60.8 liters	Short cycle 7 gallons / 26.6 liters	
Do a load of laundry		full cycle / top water level 60 gallons / 228 liters	short cycle/ low water level 27 gallons / 102.6	
Watering lawn		300 gallons / 1140 liters	Early, shorter watering 150 gallons/570 liters	
Washing car		50 gallons / 190 liters	Rinse less often 25 gallons/95 liters	
			Total Water Used	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Water Game Rubric

Student Name _____ **Date** _____

Teacher Name _____ **Class** _____

CATEGORY AND SCORE	4	3	2	1
Knowledge Gained	All students in group could easily and correctly state several facts about the topic used for the game without looking at the game.	All students in group could easily and correctly state 1 – 2 facts about the topic used for the game without looking at the game.	Most students in group could easily and correctly state 1 – 2 facts about the topic used for the game without looking at the game.	Several students in the group could NOT correctly state facts about the topic used for the game without looking at the game.
Accuracy of Content	All information cards made for the game are correct.	All but one of the information cards made for the game are correct.	All but two of the information cards made for the game are correct.	Several information cards made for the game are not accurate.
Attractiveness	Contrasting colors and at least 3 original graphics were used to give the cards and gameboard visual appeal.	Contrasting colors and at least 1 original graphics were used to give the cards and gameboard visual appeal.	Contrasting colors and "borrowed" graphics were used to give the cards and gameboard visual appeal.	Little or no color or fewer than 3 graphics were included.
Rules	Rules were written clearly enough that all could easily participate.	Rules were written, but one part of the game needed slightly more explanation.	Rules were written, but people had some difficulty figuring out the game.	The rules were not written.
Cooperative Work	The group worked well together with all members contributing significant amounts of quality work.	The group generally worked well together with all members contributing some quality work.	The group worked fairly well together with all members contributing some work.	The group often did not work well together and the game appeared to be the work of only 1-2 students in the group.
Creativity	The group put a lot of thought into making the game interesting and fun to play as shown by creative questions, game pieces and/or game board.	The group put some thought into making the game interesting and fun to play by using textures, fancy writing, and/or interesting characters.	The group tried to make the game interesting and fun, but some of the things made it harder to understand and/or enjoy the game.	Little thought was put into making the game interesting or fun.

_____ **Total Score** **Comments:**

Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

Just How Much Water Are We Talking About?

Adapted from an activity in "Water Science for Schools, at http://ga.water.usgs.gov/edu/mgd.html

Standards

Math: MA-M-2.2.3, Students will develop and apply proportionality and relationships between scale models and actual figures.

The following standard is introduced in this lesson.

Social Studies: SS-M-3.1.1, Students will understand that productive resources are limited and do not satisfy all the wants of individuals, societies and governments.

Activity Description

Students will calculate the value of one million gallons of water by comparing it to the volume of their classroom. They will also learn about water consumption in Kentucky and calculate the estimated cost of water.

Materials

- Classroom dimensions (length, width, height) measured before class
- Transparency or diagram of Figure 1 and Figure 2 on board
- Student worksheet found at end of activity (optional)

Length of Lesson

60 – 90 minutes, plus math homework (optional)

Vocabulary Words

Consumed—that part of water that is evaporated, stored in food, drunk by people or animals, or somehow removed from the local environment.
Consumption—the amount of any product or resource (e.g., water) used in a given time by a given number of consumers.
Million gallons—the measurement used in the United States to report daily water consumption. Approximately 133,500 cubic feet of water.
Withdrawal—water removed from the ground or a surface water source for use.

Essential Question

How can we learn to protect our water?

Guiding Questions

How much water do we use on a daily and yearly basis?

Skills Used

Analyze	Calculate	Visualize	Estimate
Compare	Connect	Interpret	Investigate

Just How Much Water Are We Talking About?, *continued*

Activity

Step 1: Begin by having students estimate how much water they think their classroom would hold. Have each of them write their estimate down on a piece of paper. Then assign groups of students to measure the dimensions of the room (height, length, and width.) Write each group's measurements on the board and ask for a volunteer to average the measurements for each dimension. (The classroom measurements can be written in on question # 2 on worksheet, if it is being used.) Copy student activity sheets, if using them.

Step 2: Explain to students that in order to better understand how much water is consumed in Kentucky on a daily basis, people need to be able to visualize how much a million gallons of water is, since water consumption in the U.S. is generally measured in millions of gallons. Show students the diagram on the right, or pass out copies of the student activity sheet found on the next page. Explain that when we measure things they are approximations, or close estimates, of the actual amount, since measurement tools are not 100 % accurate.

Step 3: Draw the cube and pool in the next column on the board**.** Instruct students to calculate the volume of the cube and the pool by using the formula: Volume = length x width x height (The answer for the cube is 133,511 cubic feet and 133,500 cubic feet for the pool.)

Step 4: Write the dimensions of the classroom on the board. Ask students to calculate the volume of the classroom, using the same formula listed above.

Step 5: Next have students compare the size of the classroom with the size of one million gallons of water and calculate how many classrooms

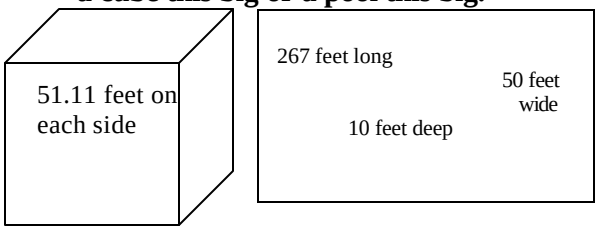
Step 5 (cont.)

it would take to hold one million gallons of water. (Divide 133,500 by the volume of the classroom to determine how many classrooms it would take.)

Step 6: Conclude this part of the lesson in measurement by asking students to think of buildings in their community they estimate would hold about 1 million gallons of water, and share the water fact on the bottom of the student worksheet.

Step 7: Finish this activity by passing out the second student activity sheet dealing with water use in the United States during 1995.

1 million gallons of water is equal to a cube this big or a pool this big.



Extensions / Variations

1. Visit the following web site to learn more about water consumption in the United States during 1995 by state:

http://ga.water.usgs.gov/edu/tables/dltotal.html

2. Make transparencies of the fact sheets found at the above web site and develop an entire math lesson based on comparing and ranking states according to water consumption.
3. Have students hypothesize, then investigate why the water consumption varies so drastically between states.
3. Contact the county water district to find out how much freshwater is withdrawn each day locally.

Just How Much Water Are We Talking About?

Student Activity Sheet 1

Name_____ **Date**_____ **Class**_____

In the United States, water consumption is expressed in millions of gallons of water used per day. 1 million gallons of water is equal to a cube this big or a pool this big.

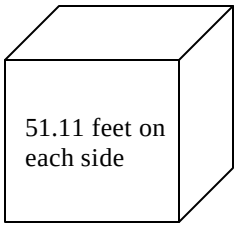


Figure 1

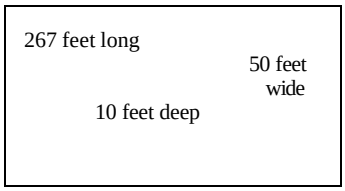


Figure 2

1. Find the volume (cubic feet of water that can be poured inside) of Figure 1 and Figure 2 by using the following formula:

volume (cubic feet) = length x width x height *(l x w x h)*

2. Find the volume of your classroom by using the same formula.

3. How many classrooms would you need to hold 1 million gallons of water?

WATER TRIVIA

The U.S. Geological Survey, estimated that in 1995, Kentuckians used approximately 4,420 million gallons of water per day. How much would that be per year?

For extra credit, solve this problem. Using the figure above for how much water Kentuckians used in a day in 1995, figure out how much water was used per day by each Kentuckian. (hint: you will need to know the population of Kentucky in 1995.) Before water was piped into the house, it was usually the job of the children and young people to carry water from the well or spring. Assuming you had a two gallon bucket, how many trips per day would you need to make to carry water for one person?

Find out if per capita water consumption has gone up or down since 1995.

Just How Much Water Are We Talking About?

Student Activity Sheet 2

Name_____ **Date**_____ **Class**_____

Use the following information supplied by the United States Geological Survey (USGS) to calculate and compare domestic water consumption in the United States in 1995.

(Withdrawals are in million s of gallons per day. Figures are rounded.)

STATE	Population in thousands	Ground Water Use			Surface Water Use			TOTAL WATER USE		
		Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Kentucky	3,860	226	0	226	4,190	0	4,190	4,420	0	4,420
Indiana	5,800	709	0	709	8,430	0	8,430	9,140	0	9,140
Illinois	11,800	928	25	953	19,000	0	19,000	19,900	25	19,925
Ohio	11,200	905	0	905	9,620	0	9,620	10,500	0	10,500
Tennessee	5,260	435	0	435	9,640	0	9,460	10,100	0	10,100
Missouri	5,320	891	0	891	6,140	0	6,140	7.030	0	7,030
West Virginia	1,830	146	.5	146	4,470	0	4,470	4,620	.5	4,620
Florida	14,200	4,340	4.6	4,340	2,880	11,000	13,800	7,210	11,000	18,200
California	32,100	14,500	185	14,700	21,800	9,450	31,300	36,300	9,640	45,900
Texas	18,700	8,370	411	8,780	16,000	4,800	20,800	24,300	5,280	29,600
New York	18,100	1,010	1.5	1,010	9,270	6,500	15,800	10,300	6,500	16,800
Alaska	604	58	75	132	154	43	196	211	117	329
Hawaii	1,190	515	16	531	497	906	1,400	1,010	922	1,930
Maine	1,240	80	0	80	141	105	246	221	105	326

On another sheet of paper, answer these questions about all 14 states included in this table.

1. What would the estimated water usage be for one week? For one year?

2. Rank the states from least amount of water consumption to greatest amount.

3. If estimated water usage increases 2% each year, calculate the estimated total water usage for each state for the year 2000.

BONUS: Research and write a short paper describing why Hawaii's water consumption is higher than Maine's even though Hawaii has a very large amount of rainfall each year.

Just How Much Water Are We Talking About?

Answers for Student Activity Sheet 2

1. **Estimated Water Usage Measured in Million Gallons (mg)**

	One Week	One Year
Kentucky	**2940 mg/week**	**152,880 mg/year**
Indiana	**63,980 mg/week**	**3,326,960 mg/year**
Illinois	**139,475 mg/week**	**7,252,700 mg/year**
Ohio	**73,500 mg/week**	**3,822,000 mg/year**
Tennessee	**70,700 mg/week**	**3,676,400 mg/year**
Missouri	**49,210 mg/week**	**2,558,920 mg/year**
West Virginia	**32,340 mg/week**	**1,681,680 mg/year**
Florida	**127,400 mg/week**	**6,624,800 mg/year**
California	**321,300 mg/week**	**16,707,600 mg/year**
Texas	**207,200 mg/week**	**10,774,400 mg/year**
New York	**117,600 mg/week**	**6,115,200 mg/year**
Alaska	**2,303 mg/week**	**119,756 mg/year**
Hawaii	**13510 mg/week**	**702,520 mg/year**
Maine	**2,282 mg/week**	**118,664 mg/year**

2. **Maine, Alaska, Hawaii, Kentucky, West Virginia, Missouri, Indiana, Tennessee, Ohio, New York, Florida, Illinois, Texas, California**

3. **Estimated Water Usage for the Year 2000 (adding on 20%)**

Kentucky	**5304 mg/day**
Indiana	**10,968 mg/day**
Illinois	**23,910 mg/day**
Ohio	**12,600 mg/day**
Tennessee	**12,120 mg/day**
Missouri	**8,436 mg/day**
West Virginia	**5,544 mg/day**
Florida	**21,840 mg/day**
California	**55,080 mg/day**
Texas	**35,520 mg/day**
New York	**20,160 mg/day**
Alaska	**394.8 mg/day**
Hawaii	**2,316 mg/day**
Maine	**391.2 mg/day**

Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

Race You to the Top of the Hill!

Standards

Math: MA-M-2.2.3, Students will develop and apply proportionality and relationships between scale models and actual figures.
Social Studies: SS-M-4.1.1, Students will understand that maps, globes, photographs, models, and satellite images are representations of Earth with different characteristics and uses.

Activity Description

Students will learn about reading and drawing topographic maps and watersheds by traveling outside their school and mapping their local micro-watershed.

Materials

- Topographic maps of local community (1 for each group of 4 students)
- Clipboards, paper and pencils for each student
- Computer use for web site research on watersheds
- Enviroscape Groundwater Model (optional)

Length of Lesson

1 – 2 class periods

Vocabulary Words

Nonpoint source pollution: Pollution that cannot be traced to a single point (e.g. outlet or pipe) because it comes from many individual sources or a widespread area (typically urban, rural, and agricultural runoff).
Point Source Pollution: pollution that can be traced to a single point source such as a pipe or culvert (e.g., industrial, wastewater treatment plant, and certain storm water discharges).
Topographic map—a map that depicts an aerial view of land by using contour lines to show the elevation of land areas, or by using satellite photos and different colors to show the different elevations.
Watershed: an area of land that all drains to a single location
Micro-watershed: —the small, immediate area of water drainage

Essential Question

How can we learn to protect our water?

Guiding Questions

- Why are topographic maps important?
- What is a micro-watershed?
- How can I find and draw my micro-watershed?

Skills Used

Map	Apply	Describe	Explore	Create
Sketch	Identify	Observe	Visualize	Discuss

Race You to the Top of the Hill!, *continued*

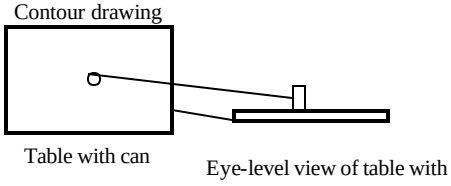
Activity

Step 1: Tell students that we want to show someone where rain goes when it falls on the school grounds. Tell them this person does not speak English so words cannot be used. Brainstorm how you could "show" this idea. Give students drawing materials and time to draw their own pictures and maps. As questions arise, record them on question strips.

Step 2: Explain to students that cartographers (map makers) have devised a way for "showing" where water flows. Students will be learning how to draw and read these "topographic" maps. This will help them better understand how water flows in their community.

Step 3: Distribute topographic maps of the local community to each small group. (Go to www.kygs.uky.edu to get topographic maps) Explain to students how a topographic map is read by referring to the map key. Work with the topographic maps for a few minutes until students appear to grasp the concept of "looking down from above" to visually understand the lay of the land. (Lay maps aside until later.)

Step 4: Tell students that they are going to draw their first topographic map — their table or desk. Remind students that they need to sketch their map to make it appear as if it is a "bird's eye view". (For students who are not strong visual learners, this task may be very difficult. It might even help to break it down into smaller steps and start by sketching just a contour map of a soft drink can sitting on a table, which would just have two different elevations.)



Step 5: After students complete the contour map of their table or desk, have them draw a map of the room, showing all of the furniture as if they can see it from the ceiling, looking down. Remind students that they need to scale all the objects down in size so they appear to be relatively the right size and distance from each other.

Step 6: Once students appear to be grasping the concept of making contour drawings, explain that they are going to be learning about watersheds, and by the end of this activity, working in groups, they will have produced a topographic map of a micro-watershed located on the school property. At this point, explain to students that a watershed is, generally speaking, a piece of land in which runoff drains toward a body of water. Watersheds come in different sizes, from a micro-watershed, which might be located in a front yard, to a large regional watershed, like the Mississippi River Basin.

Step 7: Demonstrate how water flows to lower ground levels and eventually into the closest waterways (or groundwater system) with an Enviroscape ground water model. These models are located across the state and can be borrowed free of charge. Check the teacher fact sheets for one near you. Explain to students that watershed boundaries are created depending on the flow of water from the crest, or highest area in a region. Topographic maps are important in water study because they show the highest and lowest points in a watershed.

If not using the Enviroscape model, ask students what they think happens to water when it precipitates in their area. (Students should understand that gravity forces water to flow downward to lower geographical points. Remind students of vocabu-

Race You to the Top of the Hill!, *continued*

lary covered in "Water You Supposed to Be?" lesson on the hydrologic cycle.)

Step 8: Tell students that they will be drawing a contour map of a micro-watershed on the school property so they can see how the water flows on school grounds. Prepare to go outside by gathering clipboards, paper, pencils and topographic maps.

Step 9: If some students are still having trouble understanding how to sketch contour maps, team them up with students who seem to have grasped the concept before journeying outside.

Step 10: Instruct students to locate some of the highest elevations on the school property that are easily accessible using the topographic map. Remind students that there are many micro-watersheds in any given area. Take students to the crest of a small hill, if one is available, and explain that when it rains, sleets, snows, or hails, the water eventually runs off down that small hill toward storm drains, or a body of water (anything from a puddle to a lake or river). Explain that the micro-watershed will fan out in all directions from the crest of the hill to the lowest point below.

Figure A **Figure B**

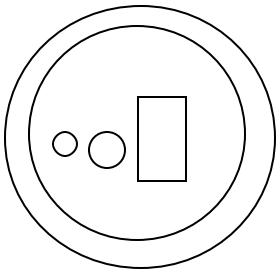
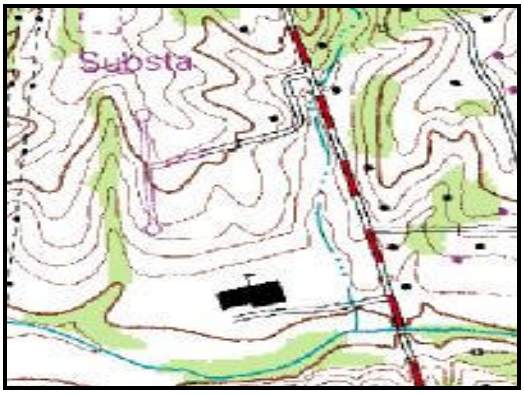


Figure C

Step 11: Once students have visually located a micro-watershed, have them sketch it from an eye-level view. Tell students to keep the sketch very simple. (See Figure A.) Then have them try to visualize the same area in a tall tree looking down on it. (See Figure B.) Finally, have students sketch the same area around the hill as if they are in the sky looking straight down on it. (See Figure C.)

<u>Technology Extension</u>: If you have access to a GPS unit, allow students to "exactly" locate the highest point in the watershed.

Step 12: Students should study the lay of the land and try to show the slope of the hillside in their contour sketch of their small area, similar to those seen on the contour map shown below that was downloaded from:. **<u>http://terraserver.homeadvisor.msn.com/default.aspx.</u>**



Step 13: Applaud student attempts at drawing contour maps, since it is a whole new way at looking at the world. It will add new insight into learning about watersheds, though, once they work through this process. Display the completed maps.

The following web site may be useful for students who need more instruction on how to draw contour maps: <u>http://academic.brooklyn.cuny.edu/geology/leveson/core/linksa/elevation.html</u>

Kentucky's Wonderful Commonwealth of Water—Be an Informed Water Citizen
Middle

Follow the Flow

Adapted from *Where is the Watershed,* **Enviroscape Activities,** Grades 6-8, pages 1-2

Standards

Social Studies: SS-M-4.1.1, Students will understand that maps, globes, photographs, models, and satellite images are representations of Earth with different characteristics and uses.
Social Studies: SS-M-4.2.1, Students will understand that places can be made distinctive by human activities that alter physical features.

Activity Description

Students will use maps to identify their local watershed areas and watershed areas for 3 of Kentucky's major rivers. Students will also use mathematical skills to recreate a scale map of their watershed area.

Materials

- Maps of Kentucky and community (1 for each group of 4 students)
- Maps of local watershed (can be downloaded from Internet)
- Poster board, markers, pencils, tape measures
- Computer use for web site research on watersheds
- Enviroscape Groundwater Model (optional)

Length of Lesson

2-3 class periods

Vocabulary Words

Nonpoint source pollution: pollution that cannot be traced to a single point (e. g. outlet or pipe) because it comes from many individual sources or a widespread area (typically urban, rural, and agricultural runoff).
Point Source Pollution: pollution that can be traced to a single point source such as a pipe or culvert (e.g., industrial, wastewater treatment plant, and certain storm water discharges).
Watershed: an area of land that all drains to a single location

Essential Question

How can we learn to protect our water?

Guiding Questions

- Where is my watershed located?
- Why is it important to learn about watersheds?

Skills Used

Analyze	Apply	Visualize	Map
Identify	Observe	Research	Organize

Follow the Flow, *continued*

Activity

Step 1: Obtain maps of your community and of Kentucky that show natural features in detail. Contact your local conservation district or the Kentucky Division of Water for assistance in locating such maps. Go to http://www.keec.ky.gov for contact information in your county.

Step 2: Ask students what they think happens to water when it precipitates in their area. Students should now understand that gravity forces water to flow downward to lower geographic points. Remind students of the vocabulary covered in the "Water You Supposed to Be?" lesson on the hydrologic cycle as well as the lesson on topographic maps.

Step 3: Divide the class into small groups and distribute the maps to each group. Discuss the map and the scale represented by the key with students. Have each group sketch a scaled drawing of Kentucky on poster board with pencils. Once the scaled map has been sketched, have them locate their community on the Kentucky map and mark it on their scaled drawing.

Step 4: Focusing back, once again, on their local community, Have students carefully study the Kentucky state map and look at the smaller waterways that are flowing into the larger river closest to their school. At this point, remind students what a watershed is. Watersheds come in different sizes, from a micro-watershed, which might be located in a front yard, to a large regional watershed such as the Mississippi river Basin. Explain to students that they will doing research to locate the boundaries of their local watershed.

Step 5: Have students go to the state watershed watch website (listed below) to help them define a watershed area and locate general information on Kentucky's waterways and 13 major watershed regions. There is also information at this site on how students can become involved in protecting their own watershed.

Http://water.nr.state.ky.us/watch

Follow the links to local watersheds for abundant information and detailed, colored maps. **(Samples of downloaded images and information on how to download images from the Internet are found at the end of this activity.)**

Step 6: After learning about Kentucky's 13 major watershed areas, instruct students to research their own watersheds by visiting the following website.

http:www.epa.gov/surf/locate/map2.cfm

Step 7: Once students have located their own watershed maps and printed them out, have them transfer that information to their group maps. Remind students that the watershed is the area around the river, not the river itself.

Follow the Flow, *continued*

Step 8: The scaled maps created by each group should show the state of Kentucky, the major river that is located in their watershed area, major towns, cities or marked developments that are within 50 miles of the river, and the shaded-in immediate watershed area. Remind students to keep their maps to scale and as accurate as possible. **Show students a copy of the rubric located on the last page of this activity so they will be aware of how this project will be graded.**

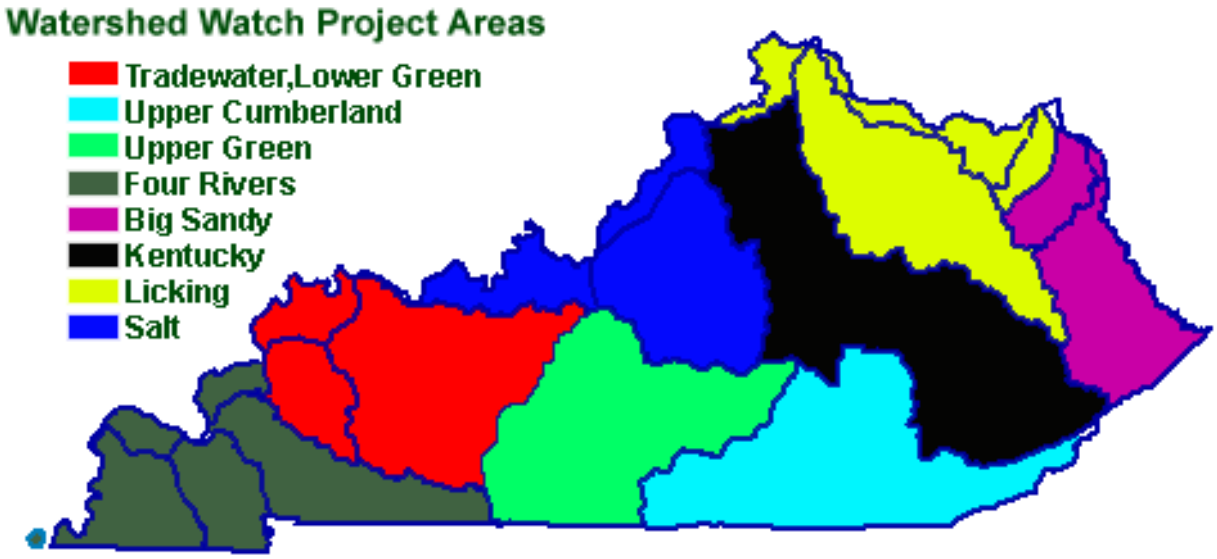
Step 9: Have students display digital images of completed maps on the class or school web site. They may also wish to take digital pictures of places in the watershed and display those as well. Maps and pictures may also be displayed in a prominent place at school, along with information learned about watersheds during this activity.

Portfolio Suggestion: Ask students to write a travel diary from the viewpoint of a drop of rain from the time it falls on the highest point in the school's watershed until it reaches the ocean.

Extensions / Variations

1. For more detailed watershed maps, have student groups identify the locations) where water comes from, where wastewater goes, whether surface runoff goes into storm drains, and where the drains empty. This information may be obtained from the local water utility, or researched by talking to people in the community.
2. Contact local elementary schools and make arrangements for students to visit intermediate classrooms to share their watershed maps and information with younger students.

Q&A: This activity connects students' local surroundings with what they have been learning. This should raise questions in their minds. Be sure and allow time for them to record both question strips and answer drops before moving to the next activity.



Map downloaded from **http://water.nr.state.ky.us/dow/dwover.htm**

Follow the Flow, *continued*

Samples of watershed maps downloaded from http://www.epa.gov/surf/locate/map2.cfm

Directions on how to download images:
1. Point mouse icon at the edge of image to download.
2. Right-click the image.
3. Highlight "save picture as" and the "save" box appears.
4. Give image a name and click "save".
5. The image will be saved in a "My Pictures" folder in C-drive.

Directions to import graphics into a Word document:
1. Click "Insert" on Tool Bar
2. Highlight "Picture" then "Clip Art"
3. Once clip art images appear, click "Import clips" and open the "My Pictures" folder in C-drive to locate the image.
4. Once the image is located, click onto it to highlight it, and click "Open" to place the image in clip art collection, then click "Insert".
5. Once image is inserted into Word document, the size of the image can be adjusted by clicking onto the image and dragging the corner of the image to the desired size.
5. Remember to credit the source from which the image was obtained.

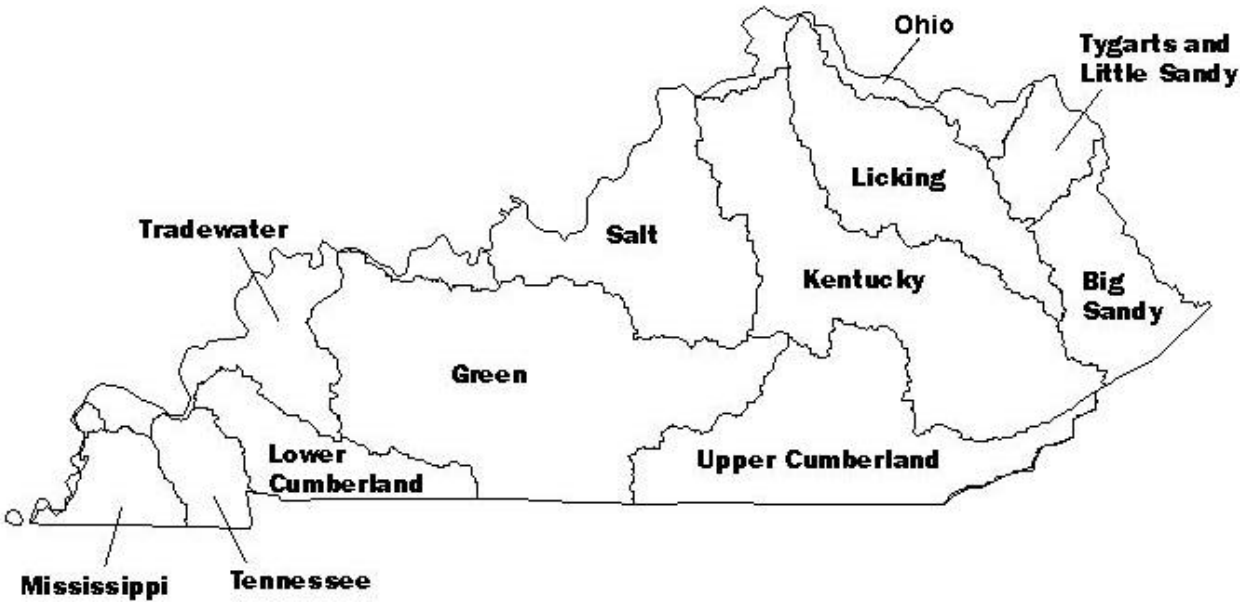
Watersheds in Kentucky

Middle Green Watershed

Close-up of Middle Green Watershed

Kentucky's 13 Major Watersheds

The Minor Ohio River Tributaries area follows the northern boarder of Kentucky, but is not shown on this map. The Tygart's and Little Sandy river basins are combined.



Map downloaded from **http://water.nr.state.ky.us/dow/dwover.htm**

Follow the Flow Map Making Rubric

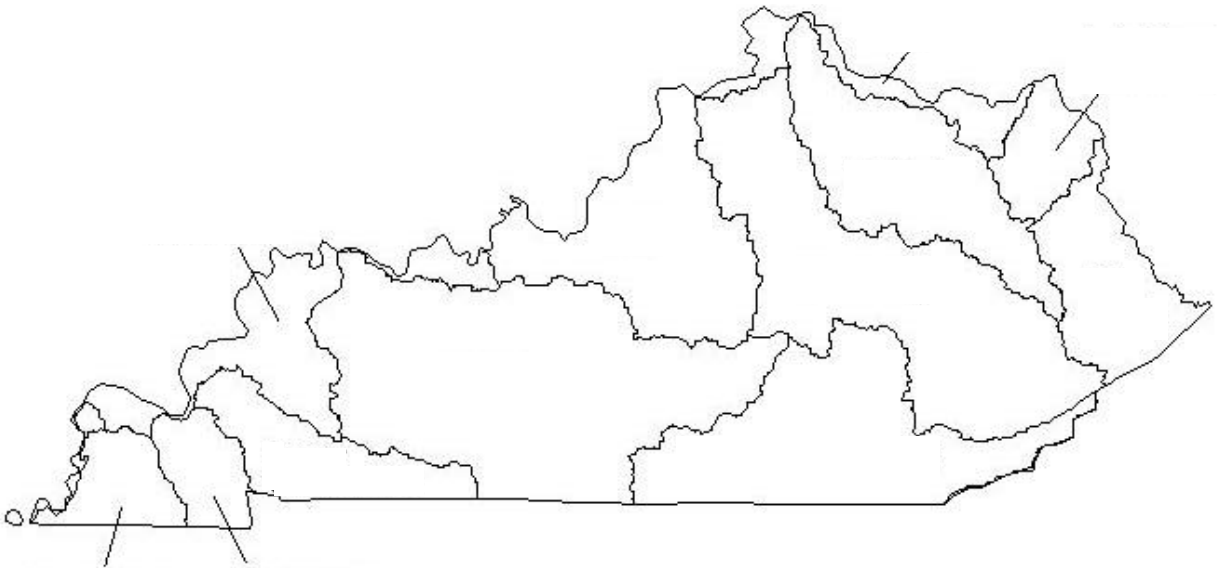
CATEGORY AND SCORE	4	3	2	1
Labels — Accuracy	At least 90% of the items are labeled and located correctly.	80 – 89% of the items are labeled and located correctly.	70 – 79% of the items are labeled and located correctly	Less than 70% of the items are labeled and located correctly.
Scale	All features on map are drawn to scale and the scale used is clearly indicated on the map.	Most features on map are drawn to scale and the scale used is clearly indicated on the map.	Many features on the map are NOT drawn to scale even though a scale is clearly indicated on the map.	Many features of the map are NOT drawn to scale AND/OR there is no scale marker on the map.
Knowledge Gained	When shown a blank base map, the student can rapidly and accurately label at least 90% of Kentucky's major watersheds.	When shown a blank base map, the student can rapidly and accurately label 80% of Kentucky's major watersheds.	When shown a blank base map, the student can rapidly and accurately label 70% of Kentucky's major watersheds.	When shown a blank base map, the student can label fewer than 70% of Kentucky's major watersheds accurately

Follow the Flow Activity Assessment

Name_____ **Date**_____ **Class**_____

1. Reflecting on information learned from completing a scaled drawing of the local watershed, write at least five things you have learned about watersheds.

2. Label this blank watershed map of Kentucky by writing in the major river basins.



Adapted from a map downloaded from **http://water.nr.state.ky.us/dow/dwover.htm**

Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

Let's Make a Watershed Model

Adapted from "Making a Watershed Model", *Instructional Models For Use With Enviroscapes,* Grades 6-8, pages 1-2

Standards

Science: SC-M-2.1.5, Students will understand that water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water dissolves minerals and gases and may carry them to the oceans.

(These two standards are introduced in this lesson.)
Math: MA-M-2.2.3, Students will develop and apply proportionality and relationships between scale models and actual figures.
Social Studies: SS-M-4.2.1, Students will understand that places can be made distinctive by human activities that alter physical features.

Activity Description

Students will create mini-watershed models that show examples of point and non-point water pollution sources and natural filters in a community. Students will also identify the interrelationships between a community and it's watershed. **Note: You may use an Enviroscape watershed model in place of this activity. (See teacher fact sheets for where you can borrow one near you.)**

Materials

- An aluminum tray or cookie sheet
- Small plastic containers of various shapes and sizes.
- Modeling clay for creating contours on the model
- Materials to build and represent different natural and man-made areas in a community such as an industrial area, a residential area, a recreational area, agricultural areas, and a landfill. Materials could include: sponge bits, soil, pebbles, dried grasses, twigs, balloons (pond and landfill liners), toothpicks, plastic wrap, aluminum foil (pipes and drainage areas), household non-toxic materials such as powdered drink mixes, cocoa powder, pancake syrup, flour, sugar, etc.
- Water and spray bottle.

Length of Lesson

Allow one class period to build models and one period to demonstrate

Vocabulary Words

Nonpoint source pollution: pollution that cannot be traced to a single point (e.g. outlet or pipe) because it comes from many individual sources or a widespread area (typically urban, rural, and agricultural runoff).
Point Source Pollution: pollution that can be traced to a single point source such as a pipe or culvert (e.g., industrial, wastewater treatment plant, and certain storm water discharges).
Best Management Practices (BMPs): effective ways to prevent or stop pollution.

Essential Question

How can we learn to protect our water?

Guiding Questions

- What are some of the causes of water pollution?
- What natural and man made filters help clean water?

Skills Used

Analyze Hypothesize Describe Evaluate

Let's Make a Watershed Model. *continued*

Activity 1

Note: You may borrow and demonstrate an Enviroscape Model in place of this activity. See teacher fact sheets for one near you.

Q&A: Make sure students have access to question strips and answer drops. Check the question board to make sure students continue to post questions on the board.

Step 1: A few days before beginning this activity, explain to students that they are going to build models of their watershed. Let students know what types of materials are suggested for use when constructing the models. Ask students to look around at home for these materials, as well as other things they think might be useful when building the watershed models. (Check instruction sheet at the end of this activity for a detailed description of how to make and demonstrate a watershed. Share this with students.)

Step 2: Prior to beginning this activity, refer to **Teacher Fact Sheets** for detailed information on watersheds and a list of places that have Enviroscape models available to loan. If an Enviroscape model is available for class use, show students how the model looks, and demonstrate how it works. This should help students have a better understanding of what is expected of them as they build their watershed model. Gather materials needed to build the student watershed models.

Step 2: Remind students of the importance of the hydrologic cycle to life on earth. Explain that as water precipitates back to the earth's surface, any materials spilled or placed on the ground's surface will eventually become part of the surface water system through runoff, or ground water system, through infiltration. Explain that human activities such as landfill use, the use of chemicals in and around the home, industrial waste disposal, farming, etc. affect the quality of both the surface and ground water everywhere. Ask students if they can explain why this is so. (Remind students that water is known as the universal solvent, and mixes easily with other substances.)

Step 3: Explain to students that during this activity they will be working in small groups to build a model of their local watershed. Tell students that their community models will each need to include a water source (stream, pond, river, . . .) and at least 3 of the following areas: residential, industrial, recreational, agricultural, forests, transportation or landfills. **Also explain that each group of students should try to make the model as realistic as possible, since the models will be used to demonstrate point and nonpoint source pollution. (Explain these definitions, if the concepts have not yet been taught.)**

Step 4: Let students know what types of materials are available for them to use. Tell students that modeling clay needs to be used to build contours, terraces, rivers, or any downhill slope where water might be running on their models.

Step 5: Allow time in class for students to complete watershed models. Remind students that they can refer to their watershed maps while constructing the models (if the lesson " Follow the Flow" has been taught.)

Step 6: Explain to students that part of the assessment on this activity will include a demonstration of each watershed model. During the demonstration, explain that each group must be prepared to identify possible types of pollutants produced in each area on their model. For example: septic tank leakage; fertilizers, herbicides and pesticides from lawns , etc.; sediment from clear-cut areas and construction zones; oil and gas from parking areas or roadways. Ask students if they can explain what causes runoff water. What causes water to infiltrate, or soak into the ground? Show students different types of powders available for them to use on their models to show the pollutants.

Let's Make a Watershed Model, *contin-*

Day 2, Activity 1

Step 1: After the models have been completed, take 3 digital photos of each model; the first one before the demonstration begins, the second one after the pollutants have been sprinkled on the model, and the third one after the water has been sprayed on the model to simulate runoff. (This is optional, but it will be useful in Activity 2.)

Step 2: Gather students around one of the groups prepared to demonstrate how their model works. Encourage each group to be very dramatic and offer thorough explanations as to what is happening when they sprinkle the appropriate pollutants in each area of their watershed model (e.g., cocoa powder for sediment, pancake syrup for manure from farm animals, drink powder or tempura for pesticides, . . .).

Step 3: Once the pollutants have been sprinkled on the model, give the group a spray bottle filled with clean water to spray on the model until runoff occurs. Students in the group should identify the source of the pollution and explain whether it is point or nonpoint source pollution. Encourage students in each group to explain what is happening to the surrounding water sources as a result of the runoff water. Ask students if it they think it would be cheaper and easier to clean up the water after it is dirty, or keep it from getting dirty in the first place.

Step 4: As each group gets through demonstrating their watershed model, drain the dirty water off the model, squirt the model with clean water and dry it with paper towels. The models will be used in the following activity on pollution prevention. **(See Extension for ideas on what to do with dirty water.)**

Activity 2

Step 1: As a large group, brainstorm ways to prevent water pollution. As students come up with ideas, hand them something with which to build their **Best Management Practices** (BMPs or pollution control) such as a piece of clay, sponge, bean sprouts (for roots of trees and plants), etc. Allow time for students to build their BMPs onto the group model.

Step 2: If students have trouble coming up with suggestions for BMPs, offer some of the following ideas that might spur them to think in more divergent ways:

- Golf course – Use less fertilizer, plant a filter strip (sponge or porous shelf liner) at bottom of hill.
- Farm field – Build terraces of clay (parallel ridges) across the hill (not up and down).
- Cars and roads – Put sand or felt filter to catch oil.
- Bare spots on landscape – Cover with grass or trees (felt or sponges).
- Factory – Build a little dam of clay to hold the effluent (waste disposal), pretend to treat it.
- Farm animals – Build a lagoon (pond or pit) to put manure in.
- Anywhere – Pick up trash.
- Use sanitary landfills, that are lined to prevent seepage, instead of sink holes or illegal dumpsites.
- Lawns-use only as much fertilizer, etc. as absolutely needed.

Let's Make a Watershed Model, *contin-*

NOTE: If time is a factor at this point, teacher may decide to do this step in small groups at the same time, instead of having a large group of students observe as the small groups take turns assessing the value of their BMPs.

Step 3: After BMP's have been added to the models, reapply the pollution to each spot. Try to make sure the pollution is inside or up-slope of the BMP. For example, if terraces are built on the farm field, try to sprinkle cocoa on the flatter spots between the terrace ridges, not on the terrace ridges themselves. If a lagoon is built for the animal waste, put the waste within the lagoon walls.

Step 4: Once again, have a group member squirt the model until the runoff reaches the body of water. Some pollutants will probably get into the lake; hopefully, it will be less than the first time when there were no BMPs in place. Discuss how BMPs do not stop pollution completely, but they do lessen the amount of pollution.

Step 5: Conclude this activity by having students analyze the ways they think pollution may be getting into the water in the school's watershed. Have them create a Best Management Practice Plan for helping to prevent the pollution. Students can then present the plan to the School Council as a Power Point presentation and/or by demonstrating one of their watershed models.

Assessment for these activities may take the form of group cooperation during the different activities, the finished product (the watershed model), the presentations, the Best Management Practices that were applied to help control pollution, and the final journal reflection. A rubric to assess oral presentations has been included to help with the scoring of the group presentations.

Extension

1. Assign groups of students to design brochures that highlight one area of watershed/ groundwater protection for their community (proper oil disposal; solid waste disposal; homeowners' use of chemicals, pesticides, or fertilizers on lawns.) These brochures can be handed out to appropriate community leaders or community groups for distribution.

2. Collect the dirty water that was left over after each demonstration. Ask students for suggestions on what to do with the dirty water. (Refer to the activity in the primary water unit called "Filtering Away Pollutants" for a similar activity.)

Controlling & Preventing Pollution

There are 3 basic methods of pollution control or prevention.

1. Structural Controls – where you build something to prevent or treat pollution.

2. Vegetative Controls – where you plant something to treat pollution.

3. Management Controls – where you do something differently to prevent pollution.

When they are used to control nonpoint source pollution, these methods are called BEST MANAGEMENT PRACTICES OR BMPS.

How to Construct and Demonstrate a Watershed Model

Step One: Gather the materials you will be using to construct and demonstrate the model. These include the following.

An aluminum cookie sheet or other nonpermeable base for the watershed model.

Plastic, paper or Styrofoam containers — used as "bases" to add height to various areas of the watershed. For example, a butter container might be the base of a large hill, while one section of an egg carton might be a small hill.

Balloons or other small pieces of flexible rubber or plastic: Used as the "bed" of streams or ponds. These materials should actually be able to hold and/or channel water.

Clay, or other moldable material for covering the "bases" so that the model both looks realistic and will actually allow water to flow across it. (Note: Paper mache and salt and flour clay may work on these models if they are only to be used for demonstration once or twice. However, since both are water soluble, they will disintegrate easily.)

Materials to make features on the clay base of the watershed. Materials could include: sponge bits, soil, pebbles, dried grasses, twigs, balloons (pond and landfill liners), toothpicks, plastic wrap, aluminum foil (pipes and drainage areas), model houses, tractors, farm animals, cars, etc.

Materials to simulate substances that get into the water from throughout the watershed. These can include the following (and what they represent): powdered tempera paint or powdered drink mixes in the following colors, green (to simulate fertilizer), red (to simulate pesticides and herbicides), brown (to simulate sediment and mud), pancake syrup (to simulate sewer and manure sludge), cooking oil to simulate oil on roads and parking lots.

Materials to simulate BMP's (Best Management Practices): These can include small pieces of green felt, sponges, absorbent shelf paper, or even alfalfa/bean sprouts to simulate areas of plant cover. Clay to construct barriers, levees or holding areas.

Step Two: Constructing the Watershed Model

Plan: Decide as a group how your watershed will look (e.g. high points, low points, number, type and size of water features, etc.). Decide what features your watershed will have and where they will be (e.g. housing development, construction sites, roads, farms, etc) List these features on paper and draw (or map) them as well.

Build: Construct your watershed to match your plan. Use the clay or other modeling material to cover the base of the watershed model and connect all the areas together. When the clay has been molded to the model, it should look like a watershed would look if there were no trees, grasses, building, etc. Don't forget that the lowest point in your watershed should be a river, stream or other body of water.

How to Construct and Demonstrate a Watershed Model (cont.)

Step Three: Demonstrating Water Pollution on Your Model

Think: Decide as a group, what kinds of pollution might flow from the various features on your model (e.g. sediment from plowed fields and construction sites, fertilizers from lawns, oil from roads and parking lots) .

Pollute! Simulate pollution on your watershed model by putting the tempura paint, syrup, oil etc. on the appropriate features. Talk about the difference between point and nonpoint source pollution.

Precipitate: Using the water bottle, make it "rain" on your model. As the various kinds of pollution dissolve in water, watch where they go? What is happening to your watershed?!?

Remediate: Clean the model. Then, using sponges, felt, clay, etc. , create BMP's (Best Management Practices) to prevent the pollution from getting into your water. In the real world such features wood include grassy areas, trees, wetlands, terraces, holding ponds etc.

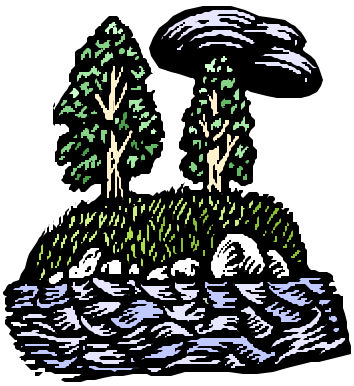
Pollute: Using the same amounts and patterns as before, place "pollutants" on your model again.

Precipitate: Using the water bottle, make it rain again in approximately the same places and amounts as before. Do your BMP's help prevent the pollution from getting into the water?

Discuss: Think about your school's watershed. Are there ways pollution might be getting into the water from your watershed?

Extension

Have students act out the play in the activity, "Who Dirties the Water?" from the High School Unit. This will help students see that water pollution is caused by all of us and it will take all of us to stop it!



Oral Presentation Rubric

Student Name _____ **Date** _____

Teacher Name _____ **Class** _____

CATEGORY AND SCORE	4	3	2	1
Preparedness	Student (group) is completely prepared and has obviously rehearsed.	Student (group) seems prepared, but might have needed a couple more rehearsals.	Student (group) is somewhat prepared, but it is clear that rehearsal was lacking.	Student (group) does not seem at all prepared to present.
Collaboration with Peers	Almost always listens to, shares with, and supports the efforts of others in the group. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others in the group. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others in the group, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others in the group. Often is not a good team member.
Comprehension	Student (group) is able to accurately address almost all questions relating to the correlation between human activities and pollution of Kentucky's waterways, including how to prevent or reduce this pollution.	Student (group) is able to accurately address most questions relating to the correlation between human activities and pollution of Kentucky's waterways, including how to prevent or reduce this pollution.	Student (group) is able to accurately address a few questions relating to the correlation between human activities and pollution of Kentucky's waterways, including how to prevent or reduce this pollution.	Student (group) is unable to accurately address questions relating to the correlation between human activities and pollution of Kentucky's waterways, including how to prevent or reduce this pollution.
Content	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.

_____ **Total Score** **Comments:**

Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

Whose Side Are You On?

Adapted from *Continuing Adventures of Truffula,* in Project Learning Tree, Secondary Guide, p. 165

Standards

Arts and Humanities: AH-M-3.1.45, Students will assume roles that communicate aspects of a character and contribute to the action based on experience, imagination, or characters in literature, history, or script.
Social Studies: SS-M-4.4.4, Students will understand that individual perspectives impact the use of natural resources (e.g. watering lawns, planting gardens, recycling paper).

Activity Description

Students will be introduced to the critical thinking process of "Issue Analysis" as they role play to answer the question, "Which group should be given custody of the last Truffula Tree seed?"

Materials

- Copies of the role cards found on page 190-191
- 3 copies of Issue Analysis Small Group Activity Sheets (included)
- "The Lorax", by Dr. Seuss, video or book

Length of Lesson

60 – 90 minutes to view video and prepare follow-up activity

Vocabulary Words

Issue Analysis—a critical thinking process of examining and evaluating alternative resolutions to perceived problems.
Current Issue—something that is viewed as a potential problem.
Values—principles, such as honesty and compassion, that are considered the basis of attitudes and behaviors.

Essential Question

How can we learn to protect our water?

Guiding Question

What is Issue Analysis and how can we use it to study current issues?

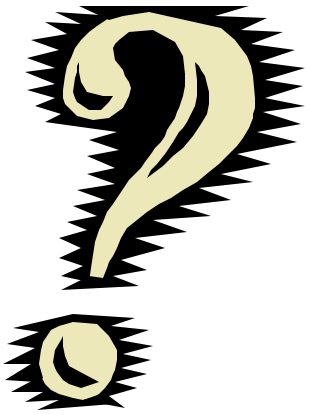
Skills Used

Analyze	Apply	Communicate	Describe
Discuss	Identify	Listen	Observe
Role play	Critique	Act	Interpret

To whom it may concern:
Re: The future of the Truffula seed

On the Street of the Lifted Lorax there arose a great need,
Just who could take care of the last Truffula seed?
The Once-ler had passed it, to a boy of just eight.
But, oh dear — oh my — he'll just have to wait!
You see it's quite simple as everyone knows,
Legal decisions must wait till he grows.
But you can help out — you're needed! Yes, you!!
Help him! Oh, help him decide what to do.

Sincerely,
The Lorax



Whose Side Are You On?, *continued*

Activity

Step 1: Prior to showing the video (or book, if the video is not available) explain to students that they will be working through a critical thinking activity known as "Issue Analysis". Explain that in an issue analysis activity, certain requirements must be met in order to better understand different sides of an existing problem. Encourage students to pay close attention to each character in the video, and try to look at what is happening from different points of view. Explain that students will be assigned to role play different positions at the end of the video. Show the video.

Step 2: As an entire class, discuss what the real issue is at the end of the video (Who should be given the final Truffula seed?)

Step 3: Either assign students to groups (Advisory Board, Neighbors, Animals, Employees) to role play the issue, or just make enough copies of the role cards (located at the end of this activity) that students will be able to draw a card that will let them know which group they will be assigned to role play.

Step 4: Before splitting into groups, read the following memo to students:

Dear Middle School Students,

The Once-ler has given the last Truffula Seed to a boy of just eight. He is too young to make a decision about what to do with the seed. I need your help to decide who should keep the last Truffula seed. It is not an easy decision but I know you can do it. Thank you for your help.

Sincerely,

The Lorax

Step 5: Give students approximately 10 – 15 minutes within their groups to fill out the Issue Analysis position paper that is found on the next page, select a spokesperson for their group, and prepare a 3 minute position statement. (The Advisory Board can spend this time reviewing all of the "facts" in the case, or walking quietly from group to group to see the process each group is using to prepare statements.)

Step 6: The Advisory Board will listen to each group testify for 3 minutes. (Appoint a timekeeper.) The board members have an opportunity to ask questions after each group presentation. After all three groups have spoken, allow time for the three opposing groups to ask each other questions, if desired. The Advisory Board then takes about a 5 minute recess to make a decision. They announce and thoroughly explain their decision to the rest of the group upon their return.

Assessment

Step 1: Assess each student group (animals, neighbors, employees) on the content and effectiveness of their presentation to the Advisory Board. Assess the Advisory Board members on the effectiveness of conducting the hearing and the explanation given for their decision.

Step 2: After the Advisory Board announces their decision, ask students to reflect, honestly, in their class notebook on the entire issue analysis process — the small group process, going before the Advisory Board, and if they felt the final decision was fair. This should give insight as to whether or not students are beginning to understand how to look at different sides of an issue.

Issue Analysis
Small Group Activity

Select a secretary for your group. Each player's name, position, beliefs and values should be recorded. Remember, there are no right and wrong answers. This is what you believe. However, you must support what you believe with facts.

MAIN ISSUE: Which group should be given custody of the last Truffula Tree seed?

Players/Positions	**The Beliefs**	**The Values**
What do you want?	What are the facts?	What is your point of view?

Advisory Board Member It is your responsibility to listen to the evidence presented and, based on the strongest rationale, vote for the group that should have custody of the Truffula seed. While the other groups are developing their rationales, you may want to review the issue analysis worksheet to better understand the different viewpoints. Try to determine if the players positions, beliefs and values are consistent. Choose a chairperson to announce the results after the groups present their positions.	**Employee Representative** **Brother Once-ler** Based on the needs of the employees, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.
Advisory Board Member It is your responsibility to listen to the evidence presented and, based on the strongest rationale, vote for the group that should have custody of the Truffula seed. While the other groups are developing their rationales, you may want to review the issue analysis worksheet to better understand the different viewpoints. Try to determine if the players positions, beliefs and values are consistent. Choose a chairperson to announce the results after the groups present their positions.	**Employee Representative** **Cousin Once-ler** Based on the needs of the employees, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.
Advisory Board Member It is your responsibility to listen to the evidence presented and, based on the strongest rationale, vote for the group that should have custody of the Truffula seed. While the other groups are developing their rationales, you may want to review the issue analysis worksheet to better understand the different viewpoints. Try to determine if the players positions, beliefs and values are consistent. Choose a chairperson to announce the results after the groups present their positions.	**Employee Representative** **Auntie Once-ler** Based on the needs of the employees, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.

Neighbor Representative Based on the needs of the neighbors, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.	**Animal Representative** **Bar-ba-loot** ***You frisk around in your Bar-ba-loot suits, in the shade of the Truffula trees, eating Truffula fruits, your sole source of food.*** Based on the needs of the animals, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.
Neighbor Representative Based on the needs of the neighbors, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.	**Animal Representative** **Humming-Fish** ***You hum while you splash about in the clear, clean water under the reflection of the Truffula trees. You are very sensitive to water pollution.*** Based on the needs of the animals, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.
Neighbor Representative Based on the needs of the neighbors, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.	**Animal Representative** **Swomee-Swan** ***Your call is heard as you fly over the tufts of the Truffula trees. You are very sensitive to smog and lose your beautiful voice when you're around it.*** Based on the needs of the animals, what would be your position, beliefs and values? Develop a rationale for why your group would make the best guardian of the Truffula seed. Elect a fearless leader to present your case to the Advisory Board. The presentation should only last for 3 minutes.

Kentucky's Commonwealth of Water: Be an Informed Water Citizen
Middle School

Curiosity Rules!

Standards

S-8-SI-3: Students will use evidence (e.g., computer models), logic, and scientific knowledge to develop scientific explanations.

Activity Description

Students review all questions that have been placed on the board during the unit and match to facts and concepts they have learned. An extension allows students to research questions that have not been answered during the unit.

Materials

Question strips and answer drops used during the entire unit.

Length of Lesson

30-45 minutes over two class periods homework time in between.

Essential Question

How can we learn to protect our water?

Guiding Questions

How can I continue to learn about water and how it affects me?

Skills Used

Questioning Research Discussion Analysis

Curiosity Rules! *Continued*

Step 1: This activity can only be done if, throughout the unit, you have been encouraging students to write any questions they have on "questions strips" and, as a class, you have been putting "answer drops" on the board with each new concept or water fact learned.

Step 2: Begin by reminding students once again that all questions are valid and no questions are silly or irrelevant if they have to do with the topic. Tell students it is important to get into the habit of asking questions both in class and in their minds since this is one of the first steps toward learning.

Step 3: Have students place all the questions strips on one side of the bulletin board—or you may write them on the chalkboard. As a class, put the questions into groups. For example, group all the questions about watersheds, all the questions about water quality and all the questions about water scarcity. Allow students to create the groupings.

Step 4: Do the same with the answer drops. These may or may not fall into the same groupings. Once this is complete, ask students to begin matching answer drops to questions strips. The goal, of course, is to find an answer for each question that has been asked. As this is being done, tell students how proud you are that they have learned so much about water!

Step 5: If students have been encouraged to ask questions and think critically throughout the unit, there will be some questions without answers. Here the activity can go in two directions. First, students can be allowed to conduct research on the unanswered questions and present that research to the class. Alternatively, students can be allowed to research their questions in the next activity, " **Let's Analyze the Issues**" .

Extension

Have each student write five questions for which they would like to have answers. Encourage them to ask "big" questions such as, " How many stars are there?" and "Why is there war?"

When students have completed their questions, tell them that nearly every question they could ask has been asked before and that all knowledge builds on knowledge that came before it.

Ask students to read some of their questions. Then ask how they might find the answers? Some students may need to become scientists themselves to find the answers!

Kentucky's Commonwealth of Water – Be an Informed Water Citizen
Middle School

Let's Analyze the Issues!

Standards

Social Studies: SS-M-1.1.2, Students will understand that democratic governments function to preserve and protect the rights (e.g., voting), liberty, and property of their citizens by making, enacting, and enforcing appropriate rules and laws (e.g., constitutions, laws, statutes)
Social Studies: SS-M-4.4.4, Students will understand that individual perspectives impact the use of natural resources (e.g. watering lawns, planting gardens, recycling paper).
Writing-WR-M-1.4, Students will use available and emerging technology to gather, organize, manipulate, and express ideas and information for a variety of authentic purposes.

Activity Description

Students will use steps involved in "Issue Analysis" to identify, research, write about, and present current water resource issues in Kentucky.

Materials

- Class set of Issue Analysis Worksheet and rubrics (included)
- Computers with Internet access for e-mail services, research and word processing program for note taking and final paper production
- Library research resources

Length of Lesson

3-4 class periods to introduce, work on and present research, with extra homework time needed

Vocabulary Words

Issue Analysis—a critical thinking process of examining and evaluating alternative resolutions to perceived problems.
Current Issue—something that is viewed as a potential problem.
Values—principles, such as honesty and compassion, that are considered the basis of attitudes and behaviors.

Essential Question

How can we learn to protect our water?

Guiding Questions

- What is a current water resource issue in our community or state?
- How did the controversy begin?
- Where is the controversy heading?
- Who controls the resources that could resolve the issue?
- What beliefs/values are at conflict with this issue?
- What stand are you going to take on the issue?
- Are you able to support your stand with unbiased evidence?

Skills Used

Analyze	Apply	Communicate	Describe
Discuss	Identify	Collaborate	Interpret
Research	Write	Present	Critique

Let's Analyze the Issues, *continued*

NOTE: This activity can be presented in different ways. It is left to the discretion of the teacher to decide which way will work best for the group of students participating in the activity.

Activity 1: Shorter, Teacher-Directed Method: Designed for students who need more direction, or if there is limited class time for this research project:

Step 1 – Before beginning this activity, collect newspaper and/or magazine articles that talk about water issues in the community or state. Most daily newspapers have online archives that are helpful in finding these articles. Go to www.kentuckyconnect.com to locate these archives.

Step 2: Tell students that this activity will involve them working within a small group to research a local or state water resource issue. Explain that they will be able to use the Internet, interview experts in the field, and use library resources for their research. Also, let students know that the project will involve a written paper, with 5 research sources cited, as well as an oral presentation. (Let students know how the sources are to be cited in their written paper.)

Step 3: Give each student a copy of the Issue Analysis worksheet, "Let's Analyze the Issues!", found at the end of this activity. Go over the nine steps each group will be expected to work through as they research the issue to arrive at a personal decision on whether to support or oppose the issue.

Step 4: Assign students to small working groups of 3 or 4 students and explain that each group will receive an article that talks about a real water resource issue. If there are enough articles, give groups 2 or 3 and let them choose the one they want to research. Explain that the group members will need to read the article, then talk about what they need to do in order to locate information to help them discover the facts about the issue, so they can analyze both sides fairly. Three good sources of online articles and information are www.water.nr.state.ky.us, www.epa.gov/water/ and www.eqc.nr.state.ky.us.

Step 6: Give students time to work through the Issue Analysis process. Provide computers for Internet research, library time for magazine, encyclopedia and newspaper research, and a list of local experts students can contact to help them answer any questions they may have. (Go to http://keec.ky.gov) to find natural resource expertise in, or near, your county.) Remind students to look for reliable sources to cite in their research paper. Set a deadline for the completion of this project. Also, give students a copy of the assessment rubric found at the end of this activity so they are aware of how this activity will be scored.

Step 8: Once student groups begin to finish their research and position papers, have them work on how they plan to present their findings and position to the rest of the class. Encourage students to be creative in their presentations, since this will keep their audience interested and give them a higher score on their presentation (if the attached scoring rubric is used.)

Step 9: Find ways for students to publish their findings from this activity, possibly at local conservation district meetings, state conferences, or through The Kentucky Technology Learning Network.

Let's Analyze the Issues, *continued*

Activity 2: Longer, Independent Research Method. Designed for students who are successful at working independently. This method will require more time for completion.

Step 1: Assign students to small working groups, and explain that they will develop a questionnaire to collect information about water resource issues in the state. Pass out copies of the Issue Analysis worksheet, "Let's Analyze the Issues!", found at the end of this activity, to give students a framework to use when preparing their questionnaire.

Step 2: Once each group has completed the first draft of their questionnaire, bring the class back together as a group to share the different questionnaires and decide on common questions from the different groups that should be included in the final draft.

Step 3: Once the class questionnaire has been revised and edited, supply students with a list of e-mail or postal addresses of experts at the local and state level who might be able to supply them with knowledgeable answers and information about water resource issues. Students may also be given a list of other contacts at schools in other parts of the state to e-mail the questionnaire to so information can be gathered from other communities. Three good sources for online information about issues are www.water.state.ky.us - www.eqc.nr.state.ky.us and www.epa.gov/water/

Step 4: While waiting for replies from the survey, instruct students to use library, media sources and Internet sources to identify and research water resource issues in Kentucky on their own. (If magazine and newspaper articles about water resource issues have been collected since the beginning of this unit, they should be beneficial as resources at this time.)

Step 5: Have students synthesize the information gathered from **Step 3** and **Step 4.** This step should start in small groups, as the material arrives or is collected, and organized according to topics, in folders or boxes.

Step 6: After students have developed a list of current water resource issues, give each small group an opportunity to select an issue to investigate further. Explain that this project will involve writing a research paper, as a group, with at least 5 research sources cited. Expla in that each group will also be responsible for giving an oral presentation before the rest of the class.

Step 7: Each group of students should work through the steps on the Issue Analysis form to arrive at a personal decision on whether to support or oppose the issue. Remind students that they will need to research the issue they select in order to have facts, rather than opinions, to study and help them formulate an educated conclusion. Give students in-class time to work on this process together. Set a deadline for completion of this project. Also, give students a copy of the assessment rubric found at the end of this activity so they are aware of how this activity will be scored.

Step 8: Once student groups begin to finish their research and position papers, have them work on how they plan to present their findings and position to the rest of the class. Encourage students to be creative in their presentations, since this will keep their audience interested and give them a higher score on their presentation (if the attached scoring rubric is used.)

Step 9: Find ways for students to publish their findings from this activity, possibly at local conservation district meetings, state conferences, or through The Kentucky Technology Learning Network.

Let's Analyze the Issues!

Name_____ **Date**_____ **Class**_____

1. **What is the main issue?**
   State the issue in the form of a question.

2. **Define any specific vocabulary needed to understand this issue.**

3. **Identify all possible positions on this issue. Which <u>two</u> are the key opposing sides?**
   Who is involved?
   Who is affected?
   Who might gain or lose?
   Who controls the resources that could resolve the issue?

4. **Find all of the <u>facts</u> that support one position by researching the issue.**
   What does this group want?
   What will they win or lose?

5. **Find all of the <u>facts</u> that support the opposite position by researching the issue.**
   What does this group want?
   What will they win or lose?

6. **What beliefs/values are in conflict in this issue?**
   What would happen in each instance if the group's idea was utilized?
   What would be the impact to others and the community, now and into the future?

7. **Take a position on the issue. Explain why you chose this position.**
   What is your opinion as to what should be done?
   How will individuals and groups get involved?

8. **How could you influence others to support your position?**
   Make an action plan.

9. **What steps did you use to analyze this issue?**

Information for this worksheet came from the following web sites: http://4h.unl.edu/citizenship/unicameral/issues.htm.
htte://www.bcpl.net/~sullivan/modules/comadv/issanalysis.htm.
http://www.mdk12.org/practices/support_success/has/critical_thinking/issue_analysis.html

Issue Analysis Research Project Rubric: Paper

Group Members _____

Teacher Name _____ **Date** _____ **Class** _____

CATEGORY AND SCORE	4	3	2	1
Problem: Issue Statement	The paper states the issue as a question, doesn't suggest solutions or judgment, focuses on a single concept, change is possible.	The paper states the issue as a question, doesn't suggest a solution or judgment, focuses on single concept, change may not be possible.	The paper states the issue as a question, but issue has only some of the required qualities.	The issue is not stated as a question, but a topic. Has few of the required qualities.
Content: Theory and Research	The paper thoroughly explains both sides of the issue. Evidence of in-depth research is clear. There is no irrelevant information.	The paper provides sufficient explanation of the issue. Evidence of adequate research is clear. There is no irrelevant information.	The paper offers insufficient explanation of the problem. There is evidence that some research has be done. Paper contains some irrelevant information.	Content offered by the group in the paper does not explain the issue nor provide basis for analysis of it. Much irrelevant information is included.
Analysis	The paper identifies how each interested party is affected by issue & alternatives; whether & how it affects the community/ state & environment; there is analysis of own group process in doing project.	The paper identifies how each interested party is affected by the issue & alternatives, whether & how it affects the community/ state & environment, but omits their group analysis process.	The paper neglects to identify all those who are affected by the issue, but does include one or two of the other requirements.	This step was skipped or only one of the requirements has been met.
Quality and Number of References	The paper cites 5 or more reliable and varied references (not just Internet sites), properly using the style shown in class as acceptable for citing sources.	The paper cites 3-5 reliable and varied references (not just Internet sites), properly using the style shown in class as acceptable for citing sources.	The paper cites 3-5 reliable sources, but the sources are not varied. The sources may or may not be cited in an acceptable manner.	The paper has fewer than 3 references. Some are from questionable sources. They may or may not be cited in an acceptable manner.
Collaboration with Peers	The group worked well together with all members contributing significant amounts of quality work..	The group generally worked well together with all members contributing some quality work.	The group worked fairly well together with all members contributing some work.	The group often did not work well together and the final paper appeared to be the work of only 1-2 students in the group.

_____**Total Score Comments:**

Issue Analysis Research Project Rubric: Oral Presentation

Group Members _____

Teacher Name _____ **Date** _____ **Class** _____

CATEGORY AND SCORE	4	3	2	1
Preparedness	The group is completely prepared and has obviously rehearsed. The project is presented in an educational and creative manner.	The group seems fairly well prepared, but might have needed a couple more rehearsals. The presentation is somewhat creative.	The group is somewhat prepared, but it is clear that rehearsal was lacking. The presentation lacks creativity.	The group does not seem at all prepared to present.
Collaboration with Peers	Every group member has an important part in the group presentation. Cooperation and support are evident	Every group member has an important part in the group presentation. Cooperation and support are somewhat evident.	Every group member has a part in the group presentation, but it is monopolized by 1 or 2 group members. Cooperation and support are lacking.	Only 1 or 2 group members participate in the oral presentation. Other group members seem uninterested. Little evidence of group cooperation and support.
Comprehension	Student (group) is able to accurately address almost all questions relating to the issue the group researched.	Student (group) is able to accurately address most questions relating to the issue the group researched.	Student (group) is able to accurately address a few questions relating to the issue the group researched.	Student (group) is unable to accurately address questions relating to the issue chosen to research.
Content	Shows a full understanding of the topic and the steps involved in Issue Analysis.	Shows a good understanding of the topic and the steps involved in Issue Analysis.	Shows a good understanding of parts of the topic and some of the steps involved in Issue Analysis.	Does not seem to understand the topic or the steps involved in Issue Analysis very well.

_____**Total Score Comments:**

Kentucky's Commonwealth of Water: Be an Informed Water Citizen
Middle School

Now's the Time to Act!

Adapted from "Give Water A Hand", University of Wisconsin Water Action Guide

Standards

Social Studies: SS-M-1.1.2, Students will understand that for the U.S. government to function as a democracy, citizens must assume responsibilities (e.g., performing community service, voting in elections) and duties (paying taxes, serving in the armed forces) for its functioning.

Activity Description

Students will work in small groups to design and implement a plan of action in their community to protect or conserve water.

Materials

- Issue Analysis research papers
- The book **50 Simple Things Kids Can Do to Save the Earth,** The Earthworks Group, 1990, pages 42-57
- Various supplies as needed, depending on the projects
- Copies of *Ranger Rick* and *Zillions* magazines from the library — most have at least one article per month on environmental responsibility for young adults.

Length of Lesson

1-2 class periods for the introductory activity in this unit, the rest will depend on the action plans selected by the students

Essential Question

How can we learn to protect our water?

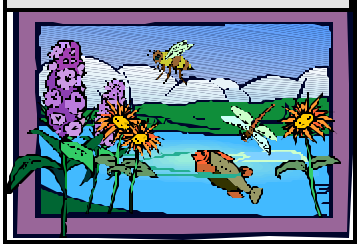
Guiding Questions

What is a service learning project that is feasible for us to do and will help make us more responsible water users?

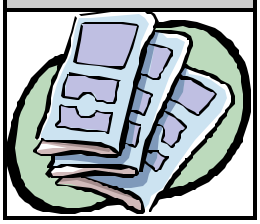
Skills Used

Analyze	Apply	Communicate	Describe
Discuss	Identify	Collaborate	Initiate
Research	Write	Present	Plan

Improve riparian habitat.



Develop educational brochures on local watersheds.



Stencil storm drains.

Educate community on using alternative cleaning products.

Now's the Time to Act!, *continued*

Activity

Note: This activity sequentially follows "Let's Analyze the Issues", since a lot of time will be spent researching current water resource issues during that activity. The research will lay the groundwork for students to decide on an issue they feel strongly about so they will be more enthusiastic about developing a plan of action.

Step 1: Review with students key points that have been covered during this water unit. Explain that this final activity will involve students deciding on something that can be done as a service project that will help protect or conserve water. Share the assessment rubric with students at the beginning of this activity so they will each understand that they are all expected to actively participate in this final unit project

Step 2: Explain to students that **service learning** combines meaningful school and community service with the learning that is taking place in the classroom. Using information learned from completing the research projects, ask students to brainstorm suggested ideas for service learning projects. Keep a master list of the ideas on the board, chart paper or overhead projector.

Step 3: Once several suggestions have been listed, explain that in order to decide on a service project that will be manageable, students should think about the cost (money as well as time commitment) of each project idea and the importance (as far as making a lasting change to water quality or conservation). Begin prioritizing the service project ideas.

Note: At this point, it is recommended that a qualified community expert be invited to come in and offer advice on the suggested projects. Check http://keec.ky.gov for natural resource experts in or near your county.

Step 4: Once the list of service learning projects has been prioritized, place students into working groups of 4-8 students, and pass out the "**Choosing a Service Learning Project**" sheet on the next page. Tell students to follow directions in filling out that sheet. That process should help each group pinpoint the service project they are qualified to initiate.

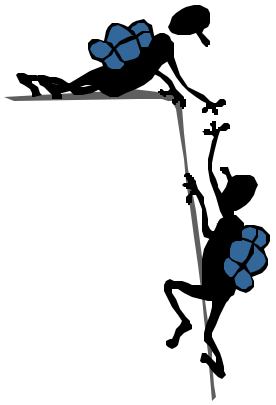
Step 5: After student groups have completed **Step 4,** ask a spokesperson from each group to report to the class on the service project their group has chosen to pursue.

Step 6: Next, pass out the **"Planning the Service Learning Project"** sheet for each group to work through together. Offer suggestions and support during this process, if needed. Call on each group to report when finished with this step.

Step 7: Finally, pass out the sheet, **"Outlining the Service Learning Project Plan"**, for each group to complete. After this step is completed, the service projects should be ready to initiate.

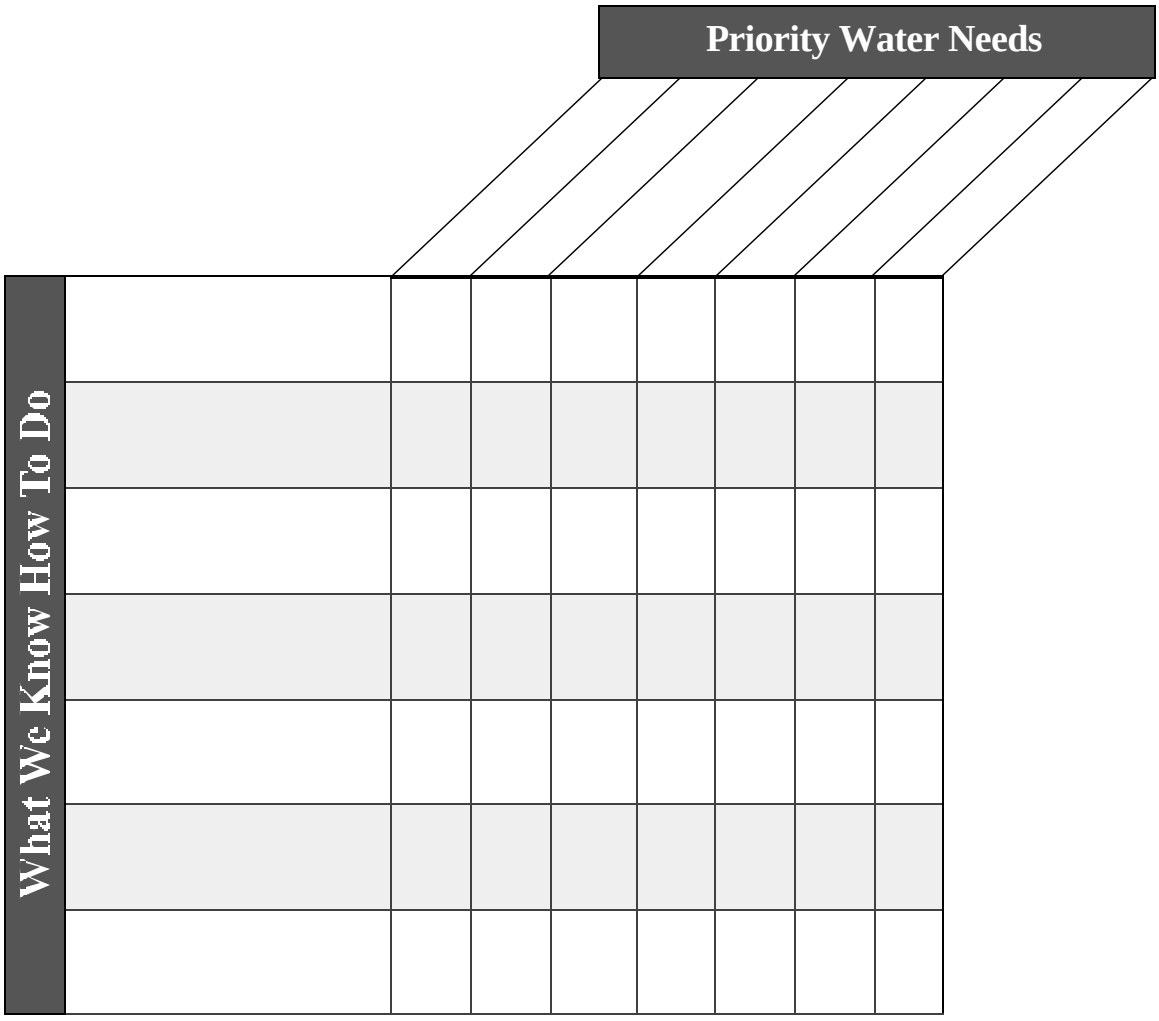
Step 8: Build in time for students to reflect (see reflection sheet prior to rubric), report on their projects to the class as well as to others, and to

CELEBRATE A JOB WELL-DONE!



Now's the Time to Act
Choosing a Service Learning Project

1 Fill out the "What We Know How To Do" column by listing things you are good at and/or enjoy doing. (Examples include art work, gardening, working on computer, talking to people, singing, ...)
2 Fill in the "Priority Water Needs" boxes at the top of the table. List top priority projects decided upon by the class.
3 Under the "Priority Water Needs" list, put an "X" in any line that matches up with something you can do that would be useful in working on that issue. (For example, if you wrote that you are good at art work and a priority need was to educate the community about conserving water, you could make posters.) Circle any "Needs" with lots of "X's" in their column. This means you have several helpers for that service project idea.
4 As a group, select the project that most interests you, then complete the bottom of this page.



Our project idea is _____
Write in the water project you select from above.

By using these skills _____
List the sk ills your group will use to do this project.

_____

We can _____ **to protect or improve water.**
Writ in the action plan you will do.

Middle School Unit

Now's the Time to Act
Planning the Service Learning Project

Group Members _____
Teacher_____ **Date**_____ **Class**_____

As a group, complete the following survey about the service learning project you have chosen.

• Would the project meet a real need? How do you know? Has it been a topic in the newspaper?)_____

• Are others working on the problem? Who are they? Can you join them?_____

• Are you excited about working on the project? If not, how could you make it exciting?

• What difference will this project make to you?_____

To your project site?_____

To the people, plants and animals in the watershed?_____

• What resources do you need to do the project? (Tools, information, skills, money, and, especially, time.)_____

Which resources do you have?_____

What resources do you still need?_____

Can you get the resources you still need? Where?_____

• What is your next step?_____

Now's the Time to Act
Outlining the Service Learning Project Plan

As a group, follow the directions as you outline your project plan at the bottom of this page.

1) Give your project a name. Make it one that people will remember. It could be simple like Butler County Middle School Stream Clean-Up or catchy like Mud Patrol: Erosion Prevention Program. Write in your group's name and project partners.

2) What is the most important task that needs to be completed first? Write it on your Project Plan under "#1 Project Task?" Write the next most important thing, and the next, until all the tasks are on the Plan.

3) Who will do each task? Write his or her name (or names) under "Who?" This person must make sure the job gets done. He or she can ask for help.

4) Brainstorm the resources (tools, information, people) you need to get each task done. Write them down. Could your partners or other experts or organizations help?

5) Get a calendar. Write today's date over "start" on the Time Line. When does the project have to be done? The end of the semester? A specific month? Write that date over "finish." How many months is it from start to finish? Using your Timeline, figure out when you need to complete each task. It often helps to start at the end date and work backwards. For example, if you are planning a Water Fair, think how much time before the Fair people need to know about it so they can plan to come. If they need to know two weeks ahead, then you must make all posters, radio ads, buttons, stickers, etc. and get them distributed by then.

6) Think of ways someone might get hurt on your project. What can you do to prevent it? What would you do if someone were hurt? Write your ideas in the "Safety Plan" box.

7) You are ready to go!

Outline of Service Learning Project Plan

Project Name_____

Project Partners_____

_____

#1 Project Task_____

Who?_____

Resources Needed_____

#2 Project Task_____

Who?_____

Resources Needed_____

#3 Project Task_____

Who?_____

Resources Needed_____

#4 Project Task_____

Who?_____

Resources Needed_____

Service Learning Project Timeline

_____ _____ _____ _____ _____ _____

Starting Date Finish Date

Safety Plan

_____

_____

_____

_____

Now's the Time to Act

Reflecting on the Completed Service Learning Project

Student_____ **Project Title**_____
Teacher_____ **Date**_____ **Class**_____

Complete the following reflection about the service learning project you have completed.

* What has been the best part of this project? Why?_____
* What has been the hardest part of this project? Why?_____
* What have you learned that you did not know at the beginning of this project?_____
* Do you feel your project benefited others? If yes, how?_____
* What data or information did you find useful?_____
* What have you learned from the people involved in this project?_____
* What have they learned from you?_____
* What have you learned about yourself and your community by doing this project?_____
* Are there ways that you could stay involved in this project in the future?_____
* If you could change anything about this project, what would it be? Why?_____
* How do you feel about service learning projects after having just completed this one?_____

Now's the Time to Act
Service Learning Project Rubric

Group Members _____

Teacher Name _____ **Class** _____

Project Title _____ **Project Completion Date** _____

CATEGORY AND SCORE	4	3	2	1
Group Participation	All students in the group enthusiastically participated in the service learning project.	At least 3/4 of the students in the group actively participated in the service learning project	At least half of the students in the group actively participated in the service learning project.	Only 1 or 2 students in the group actively participated in the service learning project.
Shared Responsibility	Responsibility for the project was shared evenly.	Responsibility for the project was shared by most group members.	Responsibility for the project was shared by 1/2 of the group members.	There was evidence of exclusive reliance on one person to do the project.
Quality of Interaction	Excellent listening and leadership skills exhibited; students reflected awareness of others' views and opinions in their discussions and work.	Students showed adeptness in interacting; lively discussion centered on the timely completion of the task .	Some ability to interact; attentive listening and cooperation; some evidence of discussion or alternative solutions when problems arose.	Little interaction; very brief cooperation, students were disinterested or distracted from completing the service learning project.
Roles Within Group	Each student assigned a clearly defined role; group members performed roles effectively.	Each student assigned a clearly defined role, some group members did not consistently adhere to roles.	Students assigned roles but roles not clearly defined or consistently adhered to.	No effort made to assign roles to group members. There was a lot of confusion within the group.

_____ **Total Score Comments:**

Middle School Reading List*

Biodiversity. By Dorothy Hinshaw Patent. Stresses the importance of protecting the planet's rich gene pool for the survival of all species.

Clean Water. By Karen Barss. Discusses the problems of maintaining a clean water supply and relates this issue to such topics as pollution, depletion of resources, and other environmental concerns.

Deserts and Drylands. By Steve and Jane Parker. Explains why deserts have developed, where they are, and why overfarming has causes them to spread. Shows how plants and animals cope with extreme temperatures and lack of water.

A Drop Of Water: A Book of Science and Wonder. By Walter Wick. Shows the different forms of water in amazingly detailed photographs; explains water's properties.

Drought. By Christopher Lampton. Investigates the causes and disastrouns effects of drought, giving the history of some of the most severe droughts on record in the U.S. and elsewhere.

Every Drop Counts. By Jill C. Wheeler, Angela Kamstra (illustrator), and Kristi Schaeppi (illustrator). Full of ideas on how kids can stop water waste at home, outside, and in school. Also talks about water pollution.

Ground Water and Surface Water: A Single Resource. U.S. Geological Survey Circular 1139 Presents an overview of the interaction of ground water and surface water, in terms of both quantity and quality, as applied to a variety of terrains across the counry. Discusses the firm scientific foundation for policies governing the management and protection of aquifers and watersheds.

Our Endangered Planet: Rivers & Lakes. By Mary Hoff and Mary M. Rodgers. Explains the way rivers and lakes work together and how we have harmed them. It tells stories of success in reviving dying rivers and lakes and of failure to preserve our fresh water.

Protecting Our Rivers and Lakes. By Rosa Costa-Pau. Presents overviews of the problems facing the survival of rivers and lakes in light of the effects and solutions to pollution and the mismanagement of resources.

Rivers: Make It Work! By Andrew Haslam, Barbara Taylor. Explains where rivers come from, why people settle near them, and how rivers form valleys and underground caves. Discusses how rivers create energy and why it's important to control flooding.

Water : A Resource in Crisis. By Eileen Lucas. Discusses the quality and quantity of water on a global scale and includes discussions of resources, the ways we use water, pollution, making water safe, taking care of our water, and taking action.

* Please note that not all books on this list are included in the PRIDE list approved for purchase. See http://www.kypride.org/ for that list.

Middle School Reading List (cont.)

Water Conservation: Student Edition. By Leslie Crawford, Jeri Hayes (Editor), Cathy Anderson (Editor) Shows students different ways to analyze, consider options, and take action on issues such as sources of water pollution, community water supply, the school water system, reading a water bill, conservation technologies and practices, and assessing costs and benefits.

Water (Designs in Science): How Technology Mirrors Nature. By Sally Morgan and Adrian Morgan. Investigates the use of water from water for energy and transportation to water as a solvent. Other topics include filtration, desalination, recycling and conservation.

Water Squeeze. By Mary O'Neill. Discusses the importance of water in our lives and the dangers we create when we pollute the waters of the planet.